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VETERINARY MEDICINE

JANUARY 1942

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VOL. XXXVII
No. 1

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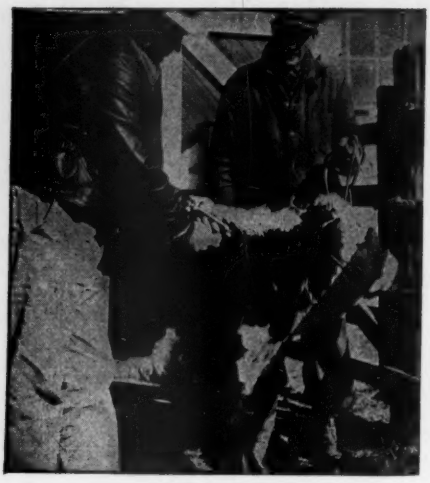
Chicago, U.S.A.

HEALTHY HEIFERS MAKE GOOD MILK COWS



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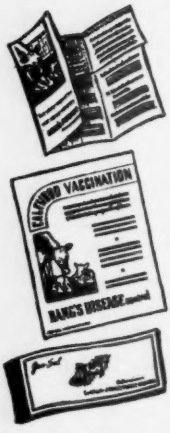

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D. M. CAMPBELL, *Editor*
7632 S. Crandon Ave., Chicago, Ill.
Telephone South Shore 7160

H. J. MOSTYN, *Eastern Representative*
1265 Broadway, New York, N. Y.
Telephone Murray Hill 4-4037

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The U. S. Census reports more than 6,000,000 farms, of which half earn about 89% of the national farm income of $9,000,000,000. Since the whole national income for 1940 was $70,000,000,000 and farmers constitute 25% of the population, proportionately their income should be $17,000,000,000 — almost twice what it really is.

Novocaine (procaine) and related products are chemically incompatible with the sulfa compounds. In a test tube these anesthetics block the germ-inhibiting action of sulfapyridine, sulfathiazole, and sulfanilamide. This has led to speculation as to the value of dusting the sulfa drugs on wounds or giving them internally when local anesthetics of this group have been employed.

A generator which kills bacteria and other microorganisms with very short sound waves has been built at the University of California. The sound waves have a frequency of 9,300 cycles per second. This tone is deadly to bacteria and to viruses as well. The method was developed in the course of an intensive study of bacteriophage, which is likewise destroyed by this frequency of sound waves.

The effect of tear gas on animals is said to be slight. Andreoni, an Italian research worker, found that only heavy concentrations affected horses and dogs, and that symptoms disappeared when the animals were removed from exposure to the gas.

The Army Medical School last year prepared 33,500,000cc (8,500 gallons) of typhoid vaccine—or 8,000,000 three-injection treatments. The vaccine was used by the Army, the Veterans Administration, the Public Health Service, the C.C.C., the Indian Service, and other departments of the federal government. The cost of manufacture was $1,540,000 less than the market price of this quantity of vaccine.

Cooperating with the more than 100 sportsmen's clubs in five counties, the state conservation department of Illinois released during last August 20,000 mature pheasants. When the year ends the department will have turned loose 130,000,000 birds. Of these 85,000 are pheasants and 45,000 are quails. This is the largest job of game propagation ever done by any one state within a year. The birds were hatched on the Illinois state game farms at Mt. Vernon, Yorkville and Springfield.

Encephalomyelitis of Cattle and Poultry

The American Foundation for Animal Health reports outbreaks of encephalomyelitis in cattle and chickens, similar to sleeping sickness in horses, in a number of the chief livestock and poultry producing states.

"The disease as it affects poultry is indicated by inability to stand and sometimes a trembling of the head and neck. Although research is still in the preliminary stage, the disease is believed by some authorities to be egg-borne. The method of transmission in cattle is not known," says the foundation report.

"Because some of the symptoms resemble those of other livestock and poultry diseases the best safeguard is prompt veterinary examination and segregation of the affected animals or fowl from the herd or flock."

* * * *

In preparing bottles of bloat medicines for clients, always use long corks so they can be easily removed. With the possible exception of a fire, or serious accident to some member of the family, perhaps nothing creates so much excitement on the farm as a bloated cow. We supply our clients with quart bottles ready for immediate use. We prepare two kinds. One, which does not "taint" the milk, is suitable for "mild bloat" or acute indigestion in dairy cows. The preparation for acute bloat renders the milk unusable for about five days. Always mention this to the client.—*E. T. B.*

* * * *

Since January, 1940, Norway has had regulations for the pasteurization of milk to be used for animal food. The work is controlled by district veterinarians, except in engineering matters, for which a dairy consultant is appointed. The law, which applies to all of Norway except three northern counties, orders that all milk products prepared in processing plants, dairies, etc., for the purpose of feeding to farm animals, must be heat-treated, either by high temperature pasteurization (over 80°C.), low temperature pasteurization (70°-72°C. for at least 15 seconds), or long time pasteurization (62°-63°C. for at least 30 minutes).

The use of alkali, such as sodium bicarbonate, with sulfathiazole is recommended by a group of Philadelphia doctors. Administration of the alkali will reduce the incidence and numbers of the crystals of the drug in the urine, with a consequent reduction in such toxic manifestations as bloody urine, urinary stones, deficient secretion of urine and other complications of the kidneys.—*J. A. M. A.*

* * * *

Tuberculosis

Of the animal diseases conveyed to man through the use of milk, tuberculosis is easily the most important. The question had its birth in 1865, when Villemin showed that tuberculosis was a communicable disease due to a germ which "behaves like a parasite; it multiplies itself and by itself." The disease "is not a spontaneous creation of the body. . . . To be born, a germ is necessary; it can come only from the outside." While the doctors discussed Villemin's findings, the veterinarians began experimenting and the great Chauveau began his classic experiments on infection through the digestive tract. The positive results obtained made him at once insist upon the necessity of taking precautions in regard to food supplies from tuberculous sources. Tuberculosis in cattle was not recognized as such at that time, but was known as "grape disease," and in France as "pommelière." Villemin held that inoculation would easily settle the question and as a result of this test declared that "calcareous phthisis of cows is identical in nature with tuberculosis in man."—*Mazyck P. Ravenel,* in *Can. P. H. Jnl.*

* * * *

The Interstate Veterinary Medical Association, meeting at Sioux City, Iowa, in October, passed a resolution urging the enlargement and elaboration of the Lincoln (Nebr.) center for the study and control of swine erysipelas. The South Western Iowa Veterinary Association, meeting at Council Bluffs, and the Eastern Iowa Veterinary Association, in session at Cedar Rapids, asked not only for the enlargement of the center at Lincoln but proposed, in their resolutions, that such a center be established in Iowa also.

Livestock Regulations That Regulate

Enforcement of existing regulations seems to be carried out with a vengeance in England. An Ayrshire farmer, who moved his sheep from the field across the road from his farmhouse to be shorn, has been fined £20 (normally $100) for disobeying a foot-and-mouth disease order. Another farmer, who thought he could slaughter his animals for food without permit, was ordered to pay £1,220 (over $5,000) in fines and costs.

* * * *

In spite of the evident shortage of feed in Great Britain, special provisions have been made for certain numbers of race horses in training, which will be allowed a specified ration of cereals. Similar allocations will be made for stallions, brood mares and certain classes of work horses.

* * * *

A new type of red blood cell, called "siderocyte" by its discoverer, has been found in newborn laboratory mice by Hans Grueneberg of University College, London. Unlike the common red blood corpuscle, it reacts to a test for iron, which would seem to indicate that it is a different compound from hemoglobin of normal blood. There is the possibility that this discovery may be of significance in the study of anemia, since the mice having these siderocyte cells are invariably anemic at birth.

* * * *

After an extensive study of proteins, minerals and vitamins in their relation to the diet of domestic animals, E. W. Crampton* cautions against the assumption that all the problems of the livestock feeder can be traced to faulty diet. Many of them can; and without a nutritionally adequate diet other remedies are of little avail in maintaining animals at efficient levels of production. On the other hand, neither proteins, minerals, nor vitamins are anything but dietary "operating needs." They are not stimulants nor medicines and cannot be used as such with hope of success.

* Associate Professor of Animal Nutrition, Macdonald College (McGill University), Quebec.

Superficial firing, when useful at all, is most successful in simple cases, but of the many strained tendons fired in this manner the advantage to the horse has seldom been very marked.—*Wooldridge Encyl.*

* * * *

Since fat stock is now being slaughtered at 600 centers instead of 16,000 as formerly, Great Britain has found it practicable to start the manufacture of glandular products. This is a comparatively new industry for Britain; formerly nearly all of these products were imported.

* * * *

Animal Disease Research

In his annual report as director of Moredun Institute for Animal Disease Research (Edinburgh) Dr. J. Russell Greig indicates that he may soon be able to report a solution of the puzzling grass sickness in horses. The Institute has done prolonged, extensive and intensive research on this disease. Dr. Greig stated that the past twenty years has been a period of remarkable progress in knowledge of specific animal diseases of major economic importance in Great Britain. Doctor Greig, it will be remembered, developed the calcium gluconate treatment for milk fever.

J. Russell Greig

* * * *

Horses Have the Proper Spirit

The National Air Raid Precautions (A.R.P.) for Animals Committee of England reports that on the outbreak of hostilities every precaution was taken for the restraint of horses in the streets of cities, but up to date restraining devices have not been necessary because of the remarkable manner in which horses have calmly carried on in the unprecedented conditions under which they live and work. The animals apparently treat the explosion of a bomb as an exaggerated backfire. Even when stables have been set afire by incendiary bombs they have behaved extremely well.

Procurement Agency for Physicians, Dentists and Veterinarians

The President has approved an order establishing a Procurement and Assignment Service for physicians, veterinarians and dentists for national defense, and appointed as a board to administer the service Dr. Frank H. Lahey, president of the A.M.A., Dr. Harold S. Diehl, dean of the medical school of the University of Minnesota, Dr. James E. Paullin, retiring president of the American College of Surgeons, Dr. Harvey B. Stone, member of the house of delegates of the A.M.A., and Dr. Caleb Willard Camalier, Jr., former president of the American Dental Association.

The function of the agency is primarily the procurement of personnel of the professions concerned for the Army, Navy, Public Health and other government services and distribution of the remaining personnel to supply these professional services for civilian needs.

In the matter of medical service the problem is already acute. Medical reserve officers now in the army have been notified that there are no medical replacements available and that they cannot be relieved upon the expiration of their year of active duty. It is thought the new agency, by stimulating voluntary enrollment of thousands of young physicians and internes in the officers reserve corps, will be able to supply both the government and civilian needs even for a much larger army than we have at present.

No shortage of dental officers has yet developed, but there is talk of greatly enlarging the army and public health service. To do so would bring about a shortage of dental officers immediately. Of veterinary reserve officers there is, at present, a surplus. Civilian communities are likely to feel the lack of veterinarians before the government services feel it. Nor is it politic to say too much about a probable shortage of veterinarians in or out of the government service. Of the veterinary officers now in the army more than half are engaged in food inspection, and as noted last month* there are others more than anxious to take over this function and do a second rate job of it.

* *Vet. Med.*, Dec., 1941, p. 586.

The first meeting of this Procurement and Assignment Service was held in Washington on November 6th. Sub-committees were established to consider the problems of medical, dental and veterinary schools, hospitals, industrial health, public health, women physicians and Negro physicians. The function of the Committee on Information will be to keep the three professions informed concerning developments and also to provide the public with necessary facts regarding this service.

* * * *

Regimental and Battalion Veterinary Personnel

The veterinary section of medical detachments of military regiments and separate battalions including a complement of animals is as follows:

1. Cavalry Regiment, horse — 1,581 animals. The regimental veterinary service comprises three officers (Capt., and two 1st Lieuts., V. C.), and 13 enlisted men.

2. Cavalry Regiment, horse and mechanized—574 animals. Veterinary section, one officer (Capt., V. C.) and six enlisted men.

3. Field Artillery Regiment, 75MM Gun, horse-drawn—910 animals. Veterinary section, two officers (Capt. and 1st Lieut., V. C.) and 14 enlisted men.

4. Division Artillery, Cavalry Division—1,194 animals. Veterinary section, two officers (Capt. and 1st Lieut., V. C.) and 14 enlisted men.

5. Field Artillery Battalion, 75MM Howitzers, pack—806 animals. Veterinary section, two officers (two 1st Lieuts., V. C.) and nine enlisted men.

6. Field Artillery Regiment, composite 75MM Gun, horse drawn — 456 animals. Veterinary section, one officer (1st Lieut., V. C.) and seven enlisted men.

* * * *

There are 1500 veterinary officers in the army veterinary reserve, 60 in the National Guard, and 126 in the Regular Army. Of those in the reserve, more than 700 are on active duty at this time.

* * * *

Nearly 250 veterinarians regularly employed in the Bureau of Animal Industry, U. S. Department of Agriculture, are now in the military service.

Outstanding Veterinary Research on B_1 Confirmed

Two and one-half years ago this magazine published an article[1] describing the syndrome produced in young dogs by depriving them of vitamin B_1 in their ration, and their prompt recovery after thiamin was administered.

In the article referred to, it was stated as probable that the discovery of the effects of thiamin privation in the dog would have far-reaching results when applied to human medicine. That prediction has been amply justified; vitamin B_1 tablets have become almost a household remedy for lack of appetite, nervousness, and related conditions in man.

The earlier vitamin B_1 research on dogs has within recent weeks received complete confirmation by tests made on humans, or rather by research into the effects of insufficient amounts of B_1 in the diet of women. These tests show a remarkable agreement with the same deficiencies in the dog as described in the original veterinary research reported nearly three years ago.

Note the parallel:

In VETERINARY MEDICINE Doctor Patton listed the following symptoms of vitamin B_1 deficiency in the dog: Irritability, restlessness, quarrelsomeness, timidity and fearfulness, gastrointestinal disturbances, muscular incoordination, intolerance to noise, spasticity of muscles, soreness over lumbar regions, photophobia, increased sensitivity to touch, weakness or wobbly gait.

In *Science News Letter*[2] research workers at the Mayo Clinic now say of the effects of vitamin B_1 insufficiency in women: "The [human] subjects became depressed, irritable, quarrelsome and fearful. They became inefficient in their work because of generalized weakness, were inattentive to details of their tasks, were confused in thought, uncertain of memory and lacked manual dexterity. . . . Headache, backache, dysmenorrhea, soreness of muscles, gastric distress after meals, sleeplessness, tenseness, paresthesia, intolerance to noise and increased sensitivity to painful stimuli were frequent complaints."

The chief difference between the two pieces of research is that the work with dogs was carried out on a vitamin B_1-free diet, whereas the work on human beings was carried out in diets deficient in vitamin B_1—0.4 to 0.45mg (133-150 International Units) daily. In the study of dogs, symptoms were observed as early as the sixth day and were pronounced on the ninth to twelfth day. In that of women, all but one could be maintained on the deficient diet for 132 to 196 days. The one patient had to be taken off the diet and given vitamin B_1 after three months.

John W. Patton

In a still earlier experiment with humans reported in October, 1940,[3] the senior author and his associates at the Mayo Clinic concluded that on a daily intake of 0.15mg vitamin B_1 (50 I. U.), the early stage of the disease induced by restricting the intake of thiamin closely resembles neurasthenia, and the later stage simulates anorexia nervosa. They concluded further that physical activity affects the rate of development of evidence of thiamin deficiency. In this experiment the shortest time for the appearance of clear evidence of deficiency on the 0.15mg (50 I. U.) daily intake was 12 days; the longest 48 days.

The remarkable agreement of these three independent pieces of research extends even further—the prompt recovery after the administration of thiamin.

The research on vitamin B_1 deficiency in dogs adds to the list, already of considerable length, of scientific researches in veterinary medicine that have paved the way for important advances in human medicine.

[1] Patton, J. W., 1939. Fright disease an avitaminosis. Vet. Med. 34:6 (June, 1939), pp. 372-381.

[2] *Science News Letter* 40:6 (August 9, 1941).

[3] Williams, Mason, Wilder and Smith, 1940. *Archives of Internal Medicine* 66 (October, 1940), pp. 785-799.

Lymphomatosis in Most Diagnoses

In the University of California diagnosis service, the trouble found in 64 per cent of the chickens was lymphomatosis (paralysis, big liver, gray eye) or infectious or parasitic diseases. In grown chickens, lymphomatosis was found most often, with infectious coryza a close second. Pullorum disease was identified in more than half the chick specimens examined.

* * * *

Largely Extended Market for Eggs

For almost a hundred years the world's supply of dry or powdered eggs has come from China. In the past 50 years the Chinese exports have grown enormously because eggs are cheap and plentiful there and the cost of labor is small so that it was hard for competitors to gain a market. Owing to the slow moving barges, which carry most of the produce from interior China, the egg is far from fresh when it reaches its destination, the desiccator. In addition, the drying process in use there includes fermentation of the eggs. The result is that when the product is used the odor is, to put it mildly, unpleasant.

Armour & Company have experimented for more than ten years in an effort to make a powdered egg acceptable to the housewife. To good roads, refrigeration, and careful handling can be credited the facility and speed with which the eggs in this country are transported, arriving at the plant while they are still fresh and wholesome. When these powdered eggs are mixed with water the appearance is much like that of freshly mixed eggs, and the odor is a pleasant one.

At the present time, however, dried or powdered eggs are of much greater importance to our armed forces than to the housewife. Eggs are 75% water and the reduction in bulk of the dried article makes it of inestimable value in the kitchens at our army posts and in the battle fields. For this purpose great quantities of powdered eggs are being sent to Great Britain. The whites and yolks are either packaged separately or combined in such proportions that they may be used as whole eggs.

Turkey Disease Studies

Turkeys that have survived an outbreak of infectious catarrhal enteritis have proved to be the most important carriers and means of transmission to susceptible poults, report University of California veterinarians. Quail and chukars were also found to carry a species of Hexamita transmissible to turkeys.

Domestic birds examined and found negative for the parasite are chickens, ducks, guinea fowl, pheasants, pea fowl, jungle fowl, grouse, blackbirds, sparrows, linnets, crows, hawks, and owls. Pigeons were found to carry a species of Hexamita not transmissible to turkey poults.

* * * *

Iodine in the Treatment of Range Paralysis

In an experiment carried out to determine the value of various agents in the treatment of lymphomatosis in fowls, Ernest Gray, Chelmsford, England, gave eight paralyzed fowls of varying breeds and of ages between ten weeks and a year injections of 10% aqueous solutions of potassium iodide. In seven cases a leucosis resulted, and in five of these uneventful recovery without relapse occurred. One bird died from what may be claimed as an incurable injury, and the seventh made a recovery followed by partial relapse and partial recovery. Injection of the potassium iodide solution into the eighth case, a dying pullet, brought down the leucocyte count and apparently prolonged the bird's life for a further week.

Seven months later two of the recovered birds, a cock and a hen, were mated. The eggs laid by the hen proved fertile. From a clutch of a dozen eggs, 12 chicks were hatched in an incubator in the poultry department of the Essex Institute of Agriculture. Eleven of these chicks were raised to maturity and at 10 months of age were healthy.

The recovery and subsequent fertility of apparently incurable cases of fowl paralysis has been experienced also by farmers who have applied the iodine treatment in the field.—*Vet. Jnl.*

Injuries to Cattle from Foreign Objects in Feed

"Sargo," the 1940 Grand Champion Steer at the International Livestock Exposition, died May 31, 1941, while on an exhibition tour in Tennessee, as a result of metallic objects in the stomach.

During 1940, a total of 4,559 beef carcasses were condemned as inedible under federal meat inspection because of pericarditis—a loss of approximately $350,000 for the year. (There were only 1,584 beef carcasses condemned for tuberculosis under federal inspection in the United States during the same year.)

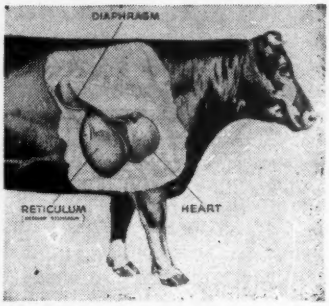


Fig. 1. Depiction of Organs in Which Foreign Bodies Become Embedded

In 1940 there were 510,858 beef livers condemned for abscess under federal inspection, constituting a loss of approximately $1,000,000. From recent observations on 2,042 cattle slaughtered in Chicago and Omaha, metallic objects were found in the stomachs of 670 or 30% of these cattle, and short pieces of baling wire or nails were found penetrating the livers in 387. A magnet drawn through alfalfa meal, collected splinters of wire too small to be detected in the stomach and yet large enough to cause an abscessed liver.

Animal pathologists say that abscesses may be formed in the liver from such objects in the stomach even though they do not penetrate the liver. In addition the reticulum lies in contact with the visceral surface of the liver. Therefore, any foreign body protruded into that portion of the wall in contact with the liver may carry infection directly into the liver.

If 30% of the abscessed beef livers are infected as a result of foreign objects in the stomach, the annual loss would be approximately $300,000 on those condemned under federal inspection, making a total loss of more than $650,000 on beef carcasses and livers condemned under federal inspection in one year from this cause. If we include state and city inspection, the loss on such condemnations would be more nearly $1,000,000 per year.

And this is but a small part of the loss. Cattle with pericarditis, abscessed livers, or any digestive disturbances resulting from foreign objects in the stomach cannot make good gains in the feedlot nor can cows so handicapped produce milk economically.

It is impossible to estimate the loss on cattle that die on farms from nails and wires penetrating the heart, but it is very large. In many cases no autopsy is performed and the owner does not know the cause of death.

Large mills often have horizontal revolving magnets suspended over the grain before it enters the grinding machinery. It

Fig. 2. Foreign Objects Taken from Stomach of a Cow

is surprising how many metallic objects are collected by these magnets and scraped off automatically into receptacles.

Those who have mills on the farm or cutters for chopping hay, in fact everyone, should be watchful and diligent in removing wires, nails, etc., so often accidentally mixed with hay and grain and swallowed by cattle.

Veterinarians are in a better position than anyone else to carry on a continuous

program of education among their patrons to the end that this enormous loss from adventitious pieces of metal in the feed of cattle be reduced materially as it can be when the livestock owner understands the hazard that they constitute to his own financial welfare and to the food supply of the nation. It is of particular importance in times of emergency like the present to prevent as much as possible all losses of this character in order to produce meat and milk more economically and to better conserve the nation's supply of foods so essential to health.—*H. R. Smith, General Manager, National Live Stock Loss Prevention Board.*

Expand Plague Control Program to Combat Eastward Spread of Infection

Bubonic plague among wild rodents has progressed steadily eastward during the past five years. This year it has been found as far east as the Dakotas. There is an increased number of infected rodents in the states originally invaded. In California two people died from the disease in the past summer.

As a result of this condition Thomas Parran, Surgeon General of the United States Public Health Service, called a conference at Salt Lake City, Utah, for August 28-29, 1941, to consider measures to prevent any more epidemics of plague in this country.

Recommendations were made that there be an expenditure of a minimum of $1,800,000; one-half to be furnished by the federal government and the remainder by states, cities and counties. The plan of procedure included: (1) Expansion of the public health service, and state surveys to determine the number and location of infected rodents; (2) Dissemination of information as to the nature and danger of the disease; (3) Organization of rat and other rodent exterminating crews who will take measures to secure rat-proofing of natural hideouts and to improve methods of garbage disposal; (4) Destruction of rats and wild rodents and the establishment of rodent-free zones about cities and other areas of dense population.

Mobile laboratory units of the U. S. Public Health Service will be made available for assistance in putting these recommendations into effect.

In this eradication project, rodents (squirrels, chipmunks, gophers, field mice, etc.) are trapped, killed and combed for fleas. If fleas harboring the plague virus are found, a systematic program of eradication of all rodents in the locality from which these flea infested animals came, is immediately carried out. Plague in the past has followed a marked increase of the disease among rodents. Mortality among people is still high. Since 1900 there have been 502 cases with 315 deaths from this disease in the United States.

Control of bubonic plague, as outlined in the recommendations of this conference, is dependent upon complete eradication of all types of rodents from infected areas. Museum authorities pronounce rodents the most successful group of mammals on earth. They are adapted to life in trees, on the ground, in underground burrows, and even in semi-aquatic surroundings, and are by far the most numerous animals among mammals. It is evident that the proposed eradication program will be a tremendous undertaking and one fraught with many difficulties. When the recommended measures are fully effective there will be little danger, in the United States, of another epidemic of plague such as occurred in California in 1907-1908.

Dr. Karl F. Meyer, director of the Hooper Foundation of the Medical School of the University of California, has done extensive research on bubonic plague and has found that when plague-infected mice are treated with anti-plague serum and sulfathiazole 98% are saved. Meyer thinks it well to take every precaution to protect people from becoming infected with the virus, but since sulfathiazole seems to be effective for the treatment of this disease there is not the danger of such devastating consequences as have followed plague epidemics in the past.

As we go to press, word is received of the death December 8th of Dr. Albert T. Kinsley, Kansas City, Mo. An obituary will be published next month.

Dr. Geo. O. Smith, Ligonier, Ind., exhibits a mare and her colt, foaled four days before the mare was two years old

Speakers at the recent annual meeting of the Southwestern Medical Association reported highly satisfactory results from the use of sulfanilamide in the treatment of "rheumatic heart disease" in children.

* * * *

New Treatment for Leucemia

A product of the atom-smashing cyclotron, radioactive phosphorus, is announced from the biological and medical research Radiation Laboratory of the University of California, as a treatment for the blood disease leucemia caused by polycythemia. This is harmless to normal tissues, in the small amounts needed, but the charged phosphorus atoms enter and destroy the abnormal cells.

It was also found that this radioactive phosphorus was rapidly taken up by cancer tissue when injected into bodies of mice having cancer. Cancer tissue takes it up faster than normal tissue such as liver and spleen in which there is ordinarily a rapid turnover of phosphorus. The radioactive phosphorus was given to six persons dying of cancer and to four dying of leucemia. On post-mortem examination it was found that the experimental results with animals were borne out.

Since the cyclotron is producing radioactive elements useful in medicine, the University of California Medical School has introduced a cyclotron course into its curriculum.

A survey of the tick situation in Puerto Rico revealed that three species are of common occurrence and economic importance; the tropical cattle tick (*Boophilus annulatus microplus*), the tropical horse tick (*Dermacentor nitens*), and the brown dog tick (*Rhicephalus sanguineus*). Standard arsenical dips, such as are used in the United States, proved to be effective in destroying the tropical cattle tick, practically all the animals being free of engorged female ticks after the second or third dipping. The arsenical dip was also effective against the horse tick, but it was found that considerably greater care is necessary in dipping horses, to insure that the dip solution comes in contact with ticks in protected places, such as the inner surface of the ear and under the tail.

* * * *

Gapuz, in experiments conducted in the Philippines, found that infusions of crushed dry derris roots in water, in concentrations of 1.25% to 5%, were effective in killing ticks on cattle and horses. It was necessary to wet the skin and hair thoroughly. He found derris root infusion preferable to arsenical solutions where application is by swabbing or spraying. At a concentration of 2.5% fresh roots or 1% dried roots, applied twice with a one-day interval between applications, the infusions were effective against equine scabies; for bovine scabies, a concentration of 3% fresh roots or 1.5% dried roots was required. The derris root infusions did not damage the skin, hair or eyes of the animals he treated.

* * * *

Endemic typhus fever, which is spread by rat fleas, had not been found north of Tennessee until quite recently when Dr. Geo. W. Stober, health officer of East Cleveland, reported a case in that city. The U. S. Public Health Service immediately sent an investigator who later discovered two more cases elsewhere in Ohio. The supposition is that the patients were bitten by fleas from rats carried from the south on food trucks or railway trains. It is thought that the increased movement of goods for the defense program will bring many more such health hazards not only in Ohio but to the entire country.

Observations of the Horse and Buggy Doctor*

We can learn a lot about how doctors are educated by studying dogs.

Higher medical standards are entirely the work of doctors themselves.

The patient will get well just as fast without suffering, so why let him suffer.

The public, taken on the whole, still occupies itself enthusiastically with placing obstructions in the path of progress of medical science.

There is no standing still in medicine. The young doctor soon finds out that much of what he learned in school turns out to be premature. His stock of knowledge turns out to be counterfeit. Time eliminates the nonessentials.

The important thing is that the suffering patient wants action. Whether there is any sense in what is being done to him is quite beside the point. He wants someone else to be interested in his pain too. He indicates that right here is the pain and he becomes impatient if his doctor with apparent lack of interest ignores the little spot and orders a blood count, a Wassermann and a chemical examination or this or that.

Let it be emphasized that the freedom from disease that the public now enjoys is the result of the labor of the regular profession. It is all right for those with minor ailments, or with none at all, to consort with the cultists. It is all right to do fool things if someone is standing by able to protect us from the fruits of our folly. But let it be emphasized, if the cultists inherited the earth the epidemic diseases would again be upon us with their original terribleness.

Most of us know far more facts than we can use intelligently.

To do research work one must have an idea of his own, a thing that comes to but few.

So far as public demand is concerned, the world might still be enjoying all the infectious diseases in their pristine glory and laudable pus might inundate the earth.

When anyone essays to publish statistics it impresses me in the same way as when one starts to relate a fishing experience. One must admit that the truth is theoretically possible.

Generally speaking, prolonged operating, as one often sees it, is due to lack of anatomical knowledge, making the operator fearful to do the long arm strokes and sharp dissection so indispensable to clean and rapid operating.

The biggest factor in aseptic surgery is prompt performance of the operation. This implies the minimum of trauma of tissues. Tissues long exposed to the air form a much more favorable culture medium for the growth of bacteria than do recently severed tissues. When incisions are left open too long the fibrin of the wound coagulates and when the wound is finally closed the tissues are no longer in the best state for prompt healing.

Clean, rapid operating will do more to minimize infections than all the face masks ever inflicted on a docile profession. Surgeons bedeck their faces with raiment and fine linen until the operating room looks like the pictures of an oriental harem. This sight gives me a pain. This uncomfortable garb tends to slow operating and bungling technic, which are the parents of infected wounds.

* *The Horse and Buggy Doctor*, by Arthur E. Hertzler, M.D., Harper and Brothers, New York, is the story of a family physician in a Kansas town of fewer than 1000 inhabitants who began a country practice more than 40 years ago. It has attained an extraordinary distribution. Apparently the public finds it a popular work. It is really a scientific discourse on the art of medicine couched in homely humor and phrases of enchanting intimacy.

By-products Useful for Riboflavin Content

The results of research on the use of distillers' by-products, which have already proved successful in the feeding of cattle,[1] by the Minnesota Experiment Station, to determine its use as a substitute for skim milk as a feed for chicks and laying hens, indicated that a 6 to 7% solution of special distillers' dried grains added to the ration supplied ample riboflavin. When a larger per cent, 20 to 30, was used, with meat scraps and soy bean meal excluded, there was inferior growth. It was presumed that the protein of this grain was of inferior quality. However, when distillers' dried solubles, containing 25 to 30% riboflavin per gram and comprising 5% of the ration was used, the growth of the pullets was comparable to that when given other feeds in which adequate riboflavin was added.

Massachusetts State College has found that corn distiller's dried grain (ground) with solubles, obtained by drying the slops of the spent grain, contains about 15 gamma of riboflavin, 6 gamma of thiamin and 1.8 Jukes units of pantothenic acid. Good results were obtained when this product replaced 50-100% of the dried buttermilk, 50% of the soybean oil meal, or 50% of the dried skimmilk and all of the fish meal in the New England College Conference chick ration. Egg production, egg weight, body weight, egg quality, and feed efficiency were equally good but the hatchability was lessened when these substitutions were made. The basal laying mash contained 2½% each of dried skimmilk, fish meal and alfalfa meal, 7½% meat scrap and with whole corn and oats was hopper fed.

C. W. S. Hartley[2] reports that in tests of several months duration he fed dried and fresh fish refuse to pigs and found that all of the additional mineral and much of the protein in a balanced ration was satisfactorily replaced by them. There was no significant difference in rate of gain whether the dried or fresh refuse was used. Nor was there a taint to the flesh when it was marketed; it was paler but of equally good flavor.

[1] *Vet. Med.*, Oct., 1941, p. 489.
[2] *Maylayan Agricultural Journal*, 1941. 29:3, pp. 118-126.

MISS MADELINE M. MARTIN
This month Miss Martin rounds out 25 years of service on the staff of VETERINARY MEDICINE. She began when the magazine was called *"The American Journal of Veterinary Medicine."* During this period she has filled efficiently the position of circulation manager and secretary of the Veterinary Magazine Corporation. Throughout the years Miss Martin has accumulated a fund of information, valuable to the veterinarian, and is ever ready to be of assistance when called upon

* * * * *

Attorney General Gail Ireland of Denver, Colorado, has recently ruled that a vicious dog is entitled to a trial by jury before he can be condemned to death.

* * * *

Fort Bliss Officers and Men Among Cavern Visitors

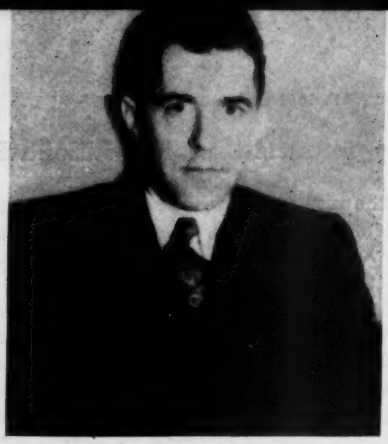
Under command of Col. D. M. Campbell, 68 members of the 30th Veterinary General Hospital, now stationed at Fort Bliss, Texas, visited Carlsbad Caverns today. The officers and men camped last night in White's City.

This veterinary hospital was organized July 27, when the enlisted personnel arrived at Fort Bliss from Rockford, Ill. The group went immediately to Louisiana, for participation in army maneuvers, held there during August and September. During those eight weeks the hospital admitted 1,905 animal casualties of which 1,882 were returned to duty.—*White's City* [*N. M*]. *Daily News* (Nov. 22 ,1941).

Purdue Clinic

Annual Short Course

Lafayette, Indiana, Oct. 15-17, 1941



Above: J. F. Bullard, Associate Professor, Department of Veterinary Science, Purdue University. Doctor Bullard was in charge of the clinic on the third day of the 29th Annual Short Course for Veterinarians held at Lafayette, October 15-17, 1941. About 225 attended the conference, which convened in the Veterinary Building at the University

Left: C. R. Donham, Head of the Department of Veterinary Science, strolling away from a cryptorchid operation which attracted a number of spectators (background). Much credit is due Doctor Donham for the stimulating program of the short course, comprising a wide range of timely topics on disease, sanitation, and control projects

Left: E. W. Kline, Thorntown, Ind., demonstrating his method of collecting blood samples from swine, to a running accompaniment of loud squeals from his indignant subject. Doctor Kline also exhibited a handy home-made stanchion which he has found useful for restraint when obtaining blood samples, as well as for many other procedures in which the head must be held firmly. The stanchion (not shown in this picture) is similar in principle to the stocks illustrated on page 376 of the July, 1941, issue of VETERINARY MEDICINE, the animal being secured by the operation of an easily-manipulated lever

Left: James Farquharson, Head of the Department of Surgery and Clinics, Colorado State College, Fort Collins, Colo., is shown at the beginning of an operation for peritoneal hernia in a heifer. On each of the first two days of the short course Doctor Farquharson spoke on Surgical Procedures, illustrating his talks with movies, and during the clinic he demonstrated several types of surgery. The others in the picture are F. L. Walkey, Assistant, Department of Veterinary Science, Purdue University (holding the microphone), H. A. Lidikay, Darlington, Ind., and Walter Smith, Valparaiso, Ind. (holding the tray)

Above (left): C. W. Fisher, Junior Veterinarian, Bureau of Animal Industry, Brownstown, Ind., inspecting the hoof of one of the clinic subjects. Right: R. E. Nichols, Associate in Veterinary Science, Purdue University, demonstrating the construction of a modified Thomas splint for dogs

Below: The group of veterinarians who participated in the clinic program. All are from Indiana unless otherwise specified. Front Row (left to right): T. L. Steenerson, Wilkinson; H. D. Carter, Fairmount; D. D. Baker, Wabash; R. E. Nichols, Lafayette; J. H. Mills, Russiaville; C. Harvey Smith, Crown Point; James Farquharson, Fort Collins, Colo.; Walter Smith, Valparaiso; E. W. Kline, Thorntown

Second Row: A. H. Schmidt, Triumph, Minn.; H. A. Lidikay, Darlington; L. E. Andres, Remington; G. L. Ebright, Hammond; F. A. Hall, Garrett; G. L. Clark, Columbia City; J. F. Bullard, Lafayette; E. S. Hess, Kentland; C. C. Donelson, Indianapolis

Third Row: P. C. Brown, Lafayette; H. Meade Hamilton, Muncie; L. P. Doyle, Lafayette; W. A. Anderson, Lafayette; C. W. Fisher, Brownstown; F. N. Andrews, Lafayette; F. L. Walkey, Lafayette; C. D. Lee, Ames, Ia., F. C. Tucker, Claypool

Violation of Serum Regulations Brings Federal Action

Violations of testing and control regulations under the Virus-Serum-Toxin Law by the Peerless Serum Co. of Kansas City, Kans., has resulted in suspension by the Secretary of Agriculture, of the company's license for 90 days.

The suspension order is to be held in abeyance, however, for a period not to exceed three years, subject to its being put into effect by a supplemental order to be issued at any time within the three-year period, without further hearing, if the Secretary of Agriculture has reason to believe that the company is violating the regulations or law.

The conclusions of a hearing at Kansas City showed that the company, by violating regulations, had used its license to facilitate the preparation, sale, and shipment in interstate commerce of worthless, contaminated, dangerous, and harmful anti-hog-cholera serum.

Laboratory Research Priority Rating

The importance of scientific research is recognized by the Priorities Division of the Office of Production Management. It has granted a priority rating of A-2 for equipment needed by research laboratories.

The Priorities Division has secured the assistance of the National Academy of Science in the operation of the new Research Laboratories Supply Plan. The academy will advise upon applications from laboratories for assistance under the plan. If a laboratory has difficulty in getting essential material and wishes A-2 rating, application should be made to the Chemical Branch, Office of Production Management, Washington, D. C., on form P D-88. If a laboratory still has difficulty after securing the A-2 rating, an application should be filed with the Priorities Division on form PD-1.

In August, 1934, President Roosevelt said of research, "The rise of research has revolutionized the diagnosis, prevention and treatment of disease . . . "

Research scientists of the Mayo Clinic found spinach second only to chestnut leaves as a source of vitamin K. Cauliflower, cabbage, pine needles and alfalfa are other rich sources of this anti-hemorrhage vitamin. Botanists of Yale University discovered heavy concentrations of vitamin B_1 in buds of oaks, red maple, horse chestnut, elm, sycamore and white pine trees.—S. N. L.

Swine Pox and Smallpox Distinct Entities

According to R. E. Shope of the Rockefeller Institute for Medical Research, human smallpox and swine pox are due to two biologically distinct viruses, although swine are susceptible to infection by both.

In the course of his research Shope inoculated two groups of hogs, one with vaccinia and the other with swine pox virus. All developed pox after the regular incubation period. After recovery each animal was reinoculated simultaneously with both viruses. All of those in the group previously infected with native swine pox developed vaccinia lesions but were immune to native smallpox. The reverse was true of the group infected with vaccinia.

Swine pox is prevalent in the Corn Belt. It is usually mild and only rarely causes a mortality of as much as 5%. The incubation period is from five to eight days. Papulopustular lesions are produced which last from six to eight days. Shope found that swine free from lice will not transmit the disease by contact even if confined in a pen with noninfected hogs, but contact infection regularly occurs with louse-infected swine after 12 to 18 days. Lice apparently act as mechanical carriers. One attack of swine pox renders the animals solidly free from reinfection.

It is not known whether swine pox is infectious for man. Presumably it is not by ordinary contact or it would be common in the middle west because of the prevalence of the disease among swine in that region. Whether man might be infected by an intermediate carrier, as swine are infected by the intervention of lice, has not been tested.

"Call a Vet"

By CARL E. SMITH

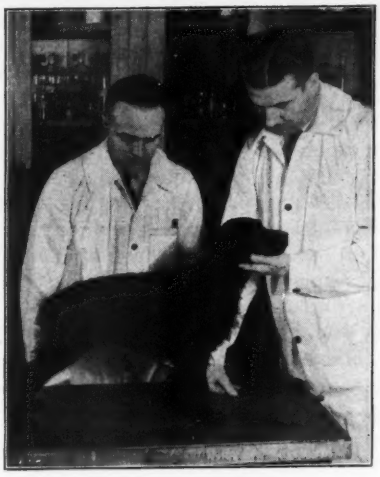
WHEN you become ill, or your wife, or Uncle Jim, Aunt Mary, or little Johnny gets sick, do you sit down and write the editor of some medical journal, and wait for him to give some cheap or free advice as to what to do? Why of course not! You wouldn't think of incurring that risk or delay, or being so procrastinating on the one hand—or so cheap, on the other.

Then why, in Heaven's name, do folks do such things, when their dogs are really sick? They need attention *now*, not some days from now, after the mails have taken a letter to the magazine, after it has had time to be forwarded to the kennel editor, and after he has had an opportunity to answer it and the mails had time to deliver same.

I have just finished answering a letter from a man four states away from here; and the brief symptoms he describes about his dog in his letter might have come from anything from the after effects of distemper to wrong feeding for a long time—or they might have come from an injury or accident. Only a veterinarian, right there on the job, could have a chance properly to diagnose the trouble; and he would need to have the dog there for some time, under observation, and for treatment a longer time yet, to see how he would respond to certain drugs, changes of diet, etc.

There isn't a chance that the kennel editor would or could hazard a guess, "sight-unseen," and at this distance, with so little data as the letter afforded. But that dog needs attention *now*. The chances are, at least, that his owner will wait until he gets our letter explaining the inability to undertake to help from here, and advising immediate veterinary treatment, before doing the obvious and calling the good veterinarian.

Why do they do it? Why suffer such delays and take such chances? If a dog is worth owning, he is worth spending a little money on, when he gets out of condition. And if you so-called dog-lovers love your dogs half as much as you pretend, you should be prompt to give them professional attention, in their distress, rather than play the cheap trick and incur the terrible delay of taking time to write some distant editor for free advice.



A sick dog needs professional care

The kennel editor is not a veterinarian, and if he were he could not prescribe intelligently for your dog at long range, any more than your own ailments would be readily and correctly cured by absent treatment, if you were sick. So, when your dog is really sick, or out of condition in a manner where he should have professional observation and prescription, and *at once*—DON'T wait days and days for a letter to the kennel editor of your favorite sporting journal to try to get your poor pooch, free, the treatment he should have. It may seem a cheap way to doctor old Sport; but it is a dirty trick on him.

Even if you are one of those thrifty individuals who aims to get $25 worth of advice from a one-dollar or two-dollar subscription, it will be a bit costly if the necessary delay costs you a valuable hunting pal. And if he isn't valuable, get rid of him, and get something that *is*—and treat him like something that is as valuable as you know him to be. A hunting pal should be something above price; at least worth prompt veterinary attention, when he really gets sick.—*Outdoors*, Dec. 1941.

Equine Ophthalmology

By B. J. ERRINGTON, Lexington, Kentucky

Department of Animal Pathology
Kentucky Agricultural Experiment Station

IN THE study of periodic ophthalmia at the Kentucky Agricultural Experiment Station the eyes of 3,443 horses and mules have been examined clinically and numerous chronic lesions as well as acute symptoms have been found. Frequently a high degree of defective vision, not suspected by those in daily contact with the animals, was found. The number of these cases emphasizes the importance of an examination of the eyes, when soundness is considered. Although the cause of many eye lesions may be obscure at this stage of equine ophthalmology, an estimation of their effect upon the vision can be made by clinical examination.

Defective vision in solipeds is most commonly caused by lesions resulting from inflammation of the iris and ciliary body (iridocyclitis). The disease known as periodic ophthalmia is primarily an iridocyclitis. Because there is more than one cause of iridocyclitis this broader term is preferable unless one is considering a particular inflammation of these structures, such as periodic ophthalmia. Because iridocyclitis is of primary importance in equine ophthalmia, the greatest consideration in this paper will be given to this disease and the related symptoms and lesions as we have observed them.

Methods of Examination

A thorough examination of the eye requires that some established routine be followed. It is advisable that observation of the external structures and appendages of the eye precede the more detailed examination of the inner structures. The following is a suggested procedure.

1. *Naked-eye examination.*—The animal should be placed facing the source of brightest light. The window of a box stall or an open outside door can be used as the source of light. By standing at arm's length in front of the animal, the observer can turn the horse's head so that one eye can be compared with the other. As in other steps of the examination, some help in making a decision is often afforded by comparing the appearance of one eye with the other.

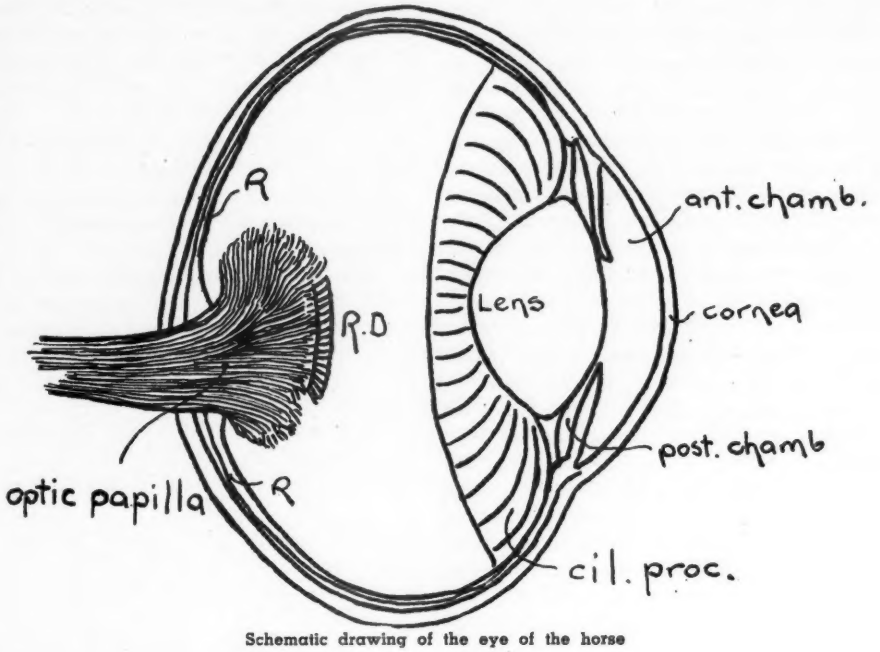
Note the shape and position of the eyelid and any evidence of injury to the lid or cornea. Observe if the conjunctiva is swollen or congested; the character of any secretion; the clearness and brilliancy of the cornea; the color and comparative size of each of the pupils; and the clearness of the aqueous humor.

2. *Tension.*—Decreased tension of the eyeball is a common symptom in both acute and chronic cases of iridocyclitis. With a decrease in tension of the eyeball, the eyelid is not held in its normal position. The atrophy allows a pit to form in the lid over the eyeball and a notch to form in the margin of the upper lid. Merely a notch in the upper lid does not necessarily indicate that there is a decreased intraocular tension, because it is seen in the conformation of many normal eyes. Determination of the tension is helpful in the prognosis as well as in the differential diagnosis between iridocyclitis and other eye diseases. Decreased tension can be detected by palpating with the index finger on the closed lid over the eye. In case of doubt as to tension, anesthetize the cornea and palpate directly upon it. Palpation should be done carefully to avoid injury to the cornea. By this procedure slight decreased tension is more easily detected than when palpating over the closed lid. For further examination the animal should be taken to the darkest part of the stall.

3. *Focal illumination.*—Some focal illumination is essential in eye examinations. For this an ordinary vest-pocket flashlight serves the purpose very well. With the rays directed from different angles, opacities and

*The investigation reported in this paper is in connection with a project of the Kentucky Agricultural Experiment Station and this record is published by permission of the Director. The paper was presented at the Veterinary Conference at Ohio State University June 20, 1941.

blood vessels of the cornea are brought out more distinctly than with natural light. Observe the degree and promptness of the iris contraction from increased light. Opacities of sufficient size and density in the vitreous or in the lens will cause a grey reflection from the pupil. The outline of the opacities in the lens can often be seen.



Schematic drawing of the eye of the horse

Frequently some magnification is desirable with focal illumination, especially to examine lesions in the conjunctiva, cornea, aqueous humor, and iris. For this purpose an otoscope, with the speculum removed, is very useful. A loupe, a magnifying lens, a slit-lamp which attaches to a battery ophthalmoscope handle, or an ophthalmoscope with a strong convex lens in the aperture may be used for such magnifying.

4. *Ophthalmoscopic examination.* — An ophthalmoscope is a necessary part of the equipment. With a little practice one can obtain the advantages which it affords in eye examinations. This instrument is used especially to examine the media (cornea, aqueous humor, lens, and vitreous) and the fundus (retina, optic disc, and choroid). An erect picture of the fundus, magnified about 10 times, is obtained. Dilation of the pupil with such agents as atropine is unnecessary unless the iris is abnormally contracted as a result of inflammation or adhesions.

It is advisable to examine all the structures systematically. One method is to begin with an examination of the media and iris, using a convex lens of 5D in the aperture, holding the instrument about 12 inches from the horse's eye. With the light directed through the pupil any opacities of the media will appear as grey or dark objects. The eye is then gradually approached to within two inches of the ophthalmoscope. When this distance is reached, it is advisable, in order to follow the movement of the horse and to protect oneself if the horse throws his head, to extend and rest a finger of the hand holding the ophthalmoscope, on the face of the horse. As the eye is approached, stronger convex lenses are placed in the sight hole of the ophthalmoscope in order to examine in detail any changes of the media or iris by

focusing directly upon them. Stronger convex lenses are required to bring the more anterior parts into focus. Many vitreous opacities will be in focus with a convex lens of 8D, while a convex lens of about 15D will focus upon the cornea.

The strength of lens required by an observer to bring any part into focus depends upon the refraction or correctness of his vision, whether or not he relaxes his accommodation, and the refraction of the horse's eye. The first two possibilities may be variables in different observers. Because they will be constant in an individual, he can reach certain conclusions as to the location of opacities by knowing which lens he requires to focus distinctly on a certain part of the horse's eye.

The location of opacities in the media can be determined by noting the direction in which they are displaced in relation to the pupil as the observer moves his head from side to side. When they remain in the same location in the pupil, they are in the plane of the iris and, therefore, near the anterior capsule of the lens. When they appear to move in the direction opposite to the observer's movement, they are anterior to the iris; when in the same direction, they are posterior to the iris. The greater the rate of movement appears to be, the farther they are from the plane of the iris. Whether opacities are in the cornea or aqueous humor can often be determined by viewing obliquely.

After the media and iris have been explored the fundus of the eye (retina, choroid and optic disc) should be examined. The choroid will be seen through the normally transparent retina. For this examination the ophthalmoscope should be held within two inches of the eye of the horse. If the eyes of both the observer and the horse are of normal refraction, which causes the image to be focused exactly upon each retina, the observer should see the fundus most distinctly with a zero lens. However, until an observer learns to relax his accommodation, he will require a concave lens up to about 3D to see the fundus of the normal eye distinctly. The observer should know and consider this variation in estimating errors of refraction, that is, whether vision is normal, near-sighted or far-sighted. If a horse is myopic (near-sighted) the weakest concave lens, or if hyperopic (far-sighted) the strongest convex lens, which produces a clear picture of the fundus, will give a rough estimation of the errors of refraction. This method is usually satisfactory in cases where it is necessary to estimate such errors. However, a more accurate measurement can be made by using a retinoscope.

5. *Errors of refraction.*—A retinoscope and trial lenses are necessary to accurately measure errors of refraction; that is to determine whether the image which is focused in the fundus of the eye is anterior to the retina (near-sighted), posterior to the retina (far-sighted), or exactly upon the retina (normal). We have seen a few cases in which the error of refraction was sufficient to affect the vision. In one instance a sire bred to a certain family of mares produced several far-sighted individuals. The importance of errors of refraction depends largely upon the type of work the animal performs. It is of most importance, of course, in racing horses and jumpers.

We are frequently asked to determine if some undesirable performance of an animal is due to defective vision. In these cases it is desirable to refract the eyes if no lesions which affect the vision are found. We use six concave and six convex trial lenses. They are in diopters of whole numbers from 1 to 6. The observer stands one meter from the eye and, with the retinoscope held close to his eye, directs its light through the pupil of the eye being examined. By rotating the retinoscope slightly the movement of the light and shadow as reflected from the fundus is observed. In an eye of normal refraction there may be no shadow movement. If the shadow moves in the same direction as the retinoscope is rotated the eye is far-sighted and trial lenses of increased convexity (+ lens) are held close to the horse's eye until one which causes a reversal of movement is reached. If the shadow moves opposite to the movement of the retinoscope

the eye is near-sighted and concave lenses (— lens) are used with the same procedure. In calculating the degree of error it is necessary to add—1 to the diopter of the lens which has caused a reversal of movement of the shadow. This will give the approximate error of refraction.

Information is also acquired from the brightness and rate of movement of the light and shadow. If the illumination is dull and movement slow the error is high. Trial lenses of fractions of a diopter would give a more accurate measurement but they are unnecessary as correcting lenses are not to be fitted to the eye. In our experience the errors of refraction are mostly far-sightedness and an error of more than 2 diopters is necessary to affect the performance of an animal.

Conjunctivitis and Keratitis

If a conjunctivitis is present one should determine whether the inflammation is: (1) associated with other diseases, as respiratory or digestive; (2) limited to the conjunctiva; or (3) involved with the uveal tract. A mere conjunctivitis with possibly a keratitis may be caused by trauma, foreign body, or irritation from dust and wind. Because these cases may be accompanied by increased lacrymation and photophobia, and frequently recur on exposure to dust and bright sunlight after the symptoms have partially subsided, they are suggestive of periodic ophthalmia. No doubt similar cases and especially those that occur during the summer months, are due to allergies. We have very little definite knowledge about such conditions in the soliped.

The conjunctiva is involved in inflammations of the iris and ciliary body caused by the anastomosis of vessels between these structures. With iridocyclitis there are symptoms other than a conjunctivitis or keratitis, which will be detected in an examination of the inner structures of the eye. Localized opacities of the cornea suggest traumatism. However, localized opacities do occur in advanced cases of periodic ophthalmia, especially when there has been greatly decreased tension. The exudate of leucocytes and fibrin into the aqueous humor in acute cases of periodic ophthalmia occasionally adheres to the cornea, in a manner resembling an opacity within the cornea.

Interstitial keratitis was commonly seen in acute cases of iridocyclitis and in traumas. The diffuse clouding of the cornea in iridocyclitis is due to lymph stasis or, in advanced cases, to leucocytic infiltration resulting from the hyperemia of the ciliary vessels which penetrate the sclera around the cornea, and to the extension of the inflammation from the tissue at the angle of the anterior chamber. Blood vessels form from the ciliary vessels at the limbus and extend into the stroma of the cornea if the degree of inflammation is severe. In traumas the opacities will be localized or decrease in density in the periphery of the site of injury. Corneal ulcers are less commonly seen in horses than in some other species.

Superficial punctate keratitis may affect a part of or the entire cornea. In the cases we observed there were no acute symptoms and in some the age suggested that the condition was congenital. There were no accompanying symptoms or lesions in other structures of the eye. The cornea appeared studded with small, grey spots which usually were about 2mm in diameter when viewed through an ophthalmoscope. With focal illumination the cornea appeared rough and greyish or cloudy if the spots were close together. They definitely affected the vision in cases where the spots were numerous in the central part of the cornea.

Cataracts

Several types of cataracts have been observed rather commonly. Punctate cataracts, varying in size from those which required some magnification to be detected to those which appeared about 2mm in diameter to the naked eye, were seen on the anterior capsule. Similar cataracts were seen less often in the cortex of the lens. In a few cases they were found in both locations. They were not numerous enough to affect the vision and many of them were not progressive over a period of two years. They were seen where there was no other significant change in the eye, as well as in cases of iridocyclitis.

On both the anterior and posterior capsules there occur, on the surface, irregular-shaped opacities resembling a deposit of exudate. These cataracts may occupy a

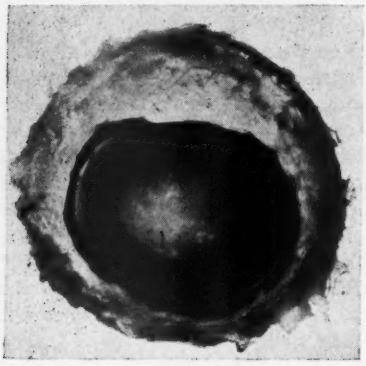


Photo by Schlotthauer

Typical cataract seen in cases of advanced recurrent ophthalmia

large part of the pupillary area and slowly increase in density until the vision is affected. In iridocyclitis an exudative deposit from the ciliary body does occur on the surface of the lens and especially on the posterior capsule. Similar cataracts were seen in numerous cases where there were no other symptoms of iridocyclitis. They were more common in aged than in young animals but many were observed in animals which would be classed as mature but not aged.

Cortical cataracts most often appear as a three-pointed star made up of fine, dust-like particles. They were seen more often in the posterior than in the anterior cortex of the lens. They seemed to be slowly progressive and in many cases due to senile changes. Although not very dense they are extensive and some apparently cause a dimness of vision. Less commonly a dense but apparently non-progressive type resembling the radiating petals of a flower was seen. These are apparently congenital. Three sharply defined lines radiating from the center and resembling a crack in glass are not infrequently seen. They are in the region of the Y-suture of the nucleus. This type appears to be congenital, does not progress, and probably affects the vision but slightly.

In nuclear cataracts the nucleus may become irregularly opaque as a mass, with the center denser than the periphery which occupies a large part of the center of the lens. Nuclear cataracts are progressive and eventually affect the vision. They appear to be due to defective nourishment of the lens as in iridocyclitis or

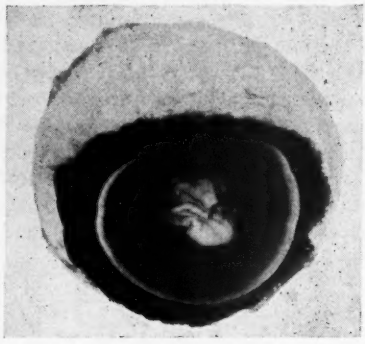


Photo by Schlotthauer

A capsular cataract projecting through the iris

in aged animals. Other lesions as vitreous opacities are often present.

Senile hardening of the lens in horses and mules is evident by the appearance of parallel concentric lines in the nasal and temporal periphery of the lens. These are commonly seen after an animal reaches 10 years of age.

When cataracts and other opacities are found, there is always the question of their effect upon the vision and how rapidly they are going to progress. Defective vision, other than blindness, must necessarily be estimated, as there is no way of measuring the degree of impairment except by the errors of refraction. Horses are able to perform surprisingly well with a high degree of defective vision. It is therefore necessary to consider the type of work the animal is to do before passing judgment on his usefulness. Horses that should be condemned for riding may have sufficient sight to perform some work quite satisfactorily. It is especially helpful to know how rapidly and to what extent a certain cataract or other opacity is going to progress. This can not always be determined, but this knowledge will gradually

be acquired through observation and records. In iridocyclitis and especially periodic ophthalmia where cataracts commonly develop as a result of other changes within the eye, the rate of progress of the cataracts seems to be difficult to estimate. In a lens there may be several types of cataract which have gradually developed for two years or more, or the lens may change from normal to entire opacity within two weeks. Periodic ophthalmia cannot be diagnosed by the type of cataract present.

Vitreous Opacities

The importance of vitreous opacities in Equidae is indicated by their common occurrence and the effect of some on the vision. They occur in a variety of forms, some of which are of little importance. Those most frequently seen are small specks scattered sparsely through the vitreous and usually close to the lens. They appear black through an ophthalmoscope. They are usually fixed in position but many are floating in the vitreous. They increase, in incidence and number, with age, and most mature horses have them. They are more common in horses than in mules. They have no relation to inflammation within the eye, but are probably pigment cells which have sloughed from the ciliary epithelium.

In foals a few weeks old it is very common to see a single floating grey thread, which remains from the fetal hyaloid artery, floating in the vitreous. It may be attached at each end and extend from the center of the optic disc to the center of the posterior capsule of the lens, or one end may be free. Occasionally it persists in older animals and often appears to have no attachment.

Vitreous opacities may be in the form of short, fine threads, which appear grey. They were see in chronic periodic ophthalmia only when accompanying other forms of opacities. They were most commonly detected in symptomatic iridocyclitis and in cases with no history of acute periodic ophthalmia.

Small grey specks may be numerous and scattered throughout the vitreous. Because of their size and color they are difficult to see by looking straight through the light beam from the ophthalmoscope. By looking to one side of the beam they can be seen in the light rays which are reflected from the fundus. In some cases they appear to have no correlation to inflammation, while in others they suggest an early vitreous change in an ophthalmia. It would seem that they should be considered with suspicion, although they are of doubtful significance.

The development of vitreous opacities in iridocyclitis is mentioned in the discussion of this disease. Vitreous opacities may take a similar course following one acute attack of iridocyclitis without any recurrence of the acute symptoms. In these cases the vitreous opacities and other chronic symptoms of iridocyclitis gradually develop and blindness results. In other cases similar vitreous opacities develop without the eye having suffered from the external symptoms of any acute ophthalmia. We have observed these latter cases which did not change materially for several years, while in others the lesions progressed until there was blindness or definitely impaired vision with or without an acute attack near the termination. For these reasons the diagnosis of periodic ophthalmia or a prognosis of the degree of vision in the future cannot be accurately determined from the type of vitreous opacity alone. The number of animals whose eyes suffer from these chronic changes emphasizes the importance of eye examinations. Vitreous opacities frequently become of sufficient size and density to cause unsoundness in horses.

Retinitis and Choroiditis

Retinitis is commonly associated with disease of the choroid or the optic nerve, and especially so in the equine species, where the independent blood supply to the retina is very limited. The symptoms are detected by examination of the fundus with an ophthalmoscope. The changes, which are usually of a chronic nature, consist mostly of a depigmentation or an exudation. Vitreous opacities do not appear to be associated with retinitis and choroiditis to any significant extent in horses and mules.

There is a considerable normal variation in the pigmented epithelium and layers of the choroid around the optic disc. If these layers do not come close to the optic papilla, the sclera shows through as a white ring partially or completely surrounding the optic disc. Ending at a variable distance from the nerve, they leave adjacent to the disc irregularly shaped, light-colored areas which might resemble a degenerative depigmentation.

Evidence of choroiditis and retinitis includes: (1) Areas in which the network of flat choroidal vessels is seen through the thinned pigment of the retina and choroid. (2) Depigmented patches with the sclera or tapetum lucidum showing through as a background of white or green mottled with black pigment. Choroidal vessels may be seen in them. If the margin is sharply defined, the inflammation is not active and little change will be seen in the area from month to month. In active choroiditis the margin is not sharply defined and the pattern of the area is continually changing. Microscopic sections of these areas show that the retina has atrophied. (3) Small grey spots of exudation. (4) A red cast which appears to be on the surface of the choroid and spreads out from the optic disc is quite often seen. The optic disc will be paler than normal. The significance of these areas is not known.

Most of the degenerative changes were observed in the area of the tapetum nigrum. There was no correlation between periodic ophthalmia and these degenerative changes in the retina and choroid. The choroid is not commonly involved in periodic ophthalmia except by extension from the posterior portion of the ciliary body.

Papillitis and atrophy of the optic nerve.—The normal disc varies in color. It may be diffusedly red of different shades, or, as seen more commonly in mature and aged animals, mottled with different shades of red. Tortuous vessels are seen on the surface. The cilio-retinal vessels vary in size and location at which they emerge from the periphery of the disc.

In papillitis the infiltration, as commonly seen in periodic ophthalmia, causes the disc to be hazy and its structure indistinct. The disc becomes more blurred with the proliferation of connective tissue upon the nerve head. More or less distinct opaque nerve fibers, which are more prominent on the nasal and temporal side of the disc, occur normally in a large percentage of horses and mules. They may be mistaken for an infiltration of the disc. However, the opaque nerve fibers cause only a blurring of the nasal and temporal margin of the disc, with the structure of the remainder of the disc being distinct.

Atrophy of the optic nerve due to pressure of a fracture was seen in traumas. It was also seen in two weanlings where it was caused by bony constriction of the optic canal, as has been reported in vitamin A deficiency of cattle. There was an accompanying, active choroiditis in each case. Blindness was gradual in these cases. The cilio-retinal vessels became smaller until very few could be seen and the disc became pale.

Iridocyclitis

The rich anastomosing vascular supply and the anatomical relationship cause the iris and ciliary body to be simultaneously involved in most cases of inflammation in either structure. Inflammation of these two structures is common in the Equidae and, as in other species, there is always a tendency for the inflammation to recur. In horses and mules the cause of the attack probably has less to do with the recurrence than the severity of the previous attack. Acute recurrent attacks may develop, or the course may be chronic. A variety of lesions are produced, some of which usually cause defective vision. The iris and ciliary body are involved in systemic diseases and traumas as well as in so-called periodic ophthalmia.

In a severe *acute* attack there is more or less conjunctivitis with increased lacrymation and photophobia. The congestion of the iris and ciliary body and the change in the permeability of the vessels cause an exudation of cells and fibrin into the substance of the iris, over its surface and into the aqueous humor. So-called plasmoid aqueous is produced which chemically re-

sembles blood plasma rather than aqueous humor. The iris is contracted and of a dull greyish color. It fails to react to changes in the intensity of light and is slow in dilating after the instillation of atropine. The exudate on the surface of the iris and in the aqueous humor tends to cause adhesions between the iris and the lens. These are detected by the failure of mydriatics to cause the iris to dilate and by irregularities in the pupillary margin of the iris.

The exudate of cells into the aqueous humor causes more or less turbidity which may be seen with the naked eye or, if slight, may be detected by examining a narrow beam of oblique illumination with some magnification. There may be a large number of leucocytes which, two or three days after the initial symptoms, will precipitate as a grey mass to the bottom of the anterior chamber (hypopyon). This exudate is usually absorbed in seven to ten days. Fibrin present may coagulate and adhere, for a longer time, to the cornea and iris.

There will be interstitial keratitis and conjunctivitis in proportion to the severity of the attack. The diffuse clouding of the cornea spreading in from the periphery occurs as mentioned in interstitial keratitis. Conjunctivitis also develops, as the vessels of the conjunctiva anastomose with the ciliary vessels. The cloudiness of the cornea and aqueous humor may make thorough examination of the iris and structures beyond it impossible until the attack has partially subsided.

Some change in the vitreous is quite constant in acute iridocyclitis. From our observations it would seem that in the first acute attack diffuse, fine, dust-like opacities form in the vitreous. In some cases there is a clouding of the vitreous without definite opacities being visible. After the acute attack has subsided dust-like opacities tend to gather and remain as a cloud in the dorsal part of the chamber.

In *subacute* attacks of iridocyclitis there may be only a slight degree of photophobia, increased lacrymation, and contraction of the iris. The cornea and aqueous humor will remain clear so that the attack might easily pass unobserved, or be mistaken for a simple conjunctivitis. Diagnosis will most often be made by the contracted pupil with an increased turbidity of the vitreous and a slight decrease in tension. In three or four days the pupil is apt to be normal, with the turbidity of the vitreous and decreased tension persisting for a longer time. The first or the succeeding attacks may be very severe or of a subacute character. Often the most severe attacks are early in the course of the disease. Each recurrent attack then diminishes in severity until the process is chronic with no acute flare-ups. However, the disease does not always follow this course. The recurrent attacks as well as the first attack may be either very severe or of a subacute character.

With each recurrent attack, diffuse dust-like opacities form in the vitreous and the opacities which remain between attacks become more dense. Filaments eventually form and increase until there are dense, membranous opacities and the vision is permanently defective. Filaments and membranous opacities are usually floating in the vitreous. These vitreous opacities which become dense enough to affect the vision may gradually develop without a recurrence of even the subacute symptoms of the disease. After filaments and membranes are formed there is little possibility of their decreasing. On the contrary there is always a tendency for them to increase in density.

Fixed opacities also form from the ciliary body as an exudate which follows the anterior limiting membrane of the vitreous over the posterior surface of the lens. Leucocytes, plasma cells and occasional pigment cells which have sloughed from the ciliary epithelium are included. These irregular masses form an opacity which appears to be a cataract on the posterior capsule of the lens. Connective tissue gradually forms during the chronic stages until there is a dense membrane, which is called a cyclitic membrane, over the entire posterior surface of the lens.

Chronic lesions of iridocyclitis that are quite evident by a naked-eye examination

are cloudiness or dense opacities of the cornea, irregularities in the pupillary margin of the iris resulting from adhesions; and a cloudy or grey pupil caused by opacities of the lens or vitreous. Vitreous

Photo by Schlotthauer

Detachment of the retina caused by subretinal exudate or hemorrhage

opacities are quite constant and their type depends upon the number of attacks and their severity. The tension of the eyeball usually remains decreased after several attacks of iridocyclitis. Capsular, lenticular or entire cataracts form. The cellular infiltration and connective tissue proliferation of the optic papilla cause this structure to appear hazy or blurred on ophthalmoscopic examination. Grey finger-like processes radiating from the optic disc due to the connective tissue proliferation and beginning detachment of the retina are seen. When the retina is completely detached it appears as a uniformly dense, floating opaque membrane. Because it usually remains attached around the optic disc it will appear more or less funnel-shaped, with the larger diameter anterior. It will thus differ from vitreous membranes, which either follow the curvature of the lens or appear to hang from above or to float irregularly through the vitreous. However, the retina continues to atrophy after being detached and its structure becomes disorganized. In this state it may not be recognized as a detached retina when viewed through an ophthalmoscope and one may wonder why these cases are totally blind if the vitreous or other opacities do not completely obscure the fundus, since a detached retina cannot be distinguished.

Periodic Ophthalmia

The preceding discussion of iridocyclitis pertains to so-called periodic ophthalmia as this disease is primarily an inflammation of the iris and ciliary body. The other symptoms and lesions in the conjunctiva, cornea, aqueous humor, lens, vitreous humor, retina and optic disc are results of the primary iridocyclitis.

The course of the disease is quite variable. In the first acute attack the symptoms may be very severe, with a recurrent attack occurring in one or two months. Each such attack is less severe and the duration between attacks gradually lengthens. However, the second attack may be many months after the first attack, or the lesions may gradually progress from a first acute attack until blindness results without a second acute attack having occurred. In other cases the first few attacks may be very mild. Unless the eye is thoroughly examined, the slight conjunctivitis and increased lacrymation, which are all that has been observed, are passed as a simple conjunctivitis.

There is also a chronic form of ophthalmia, with clinical and histopathological lesions similar to periodic ophthalmia; and this chronic form may never show acute external symptoms. Animals affected with this form may have suffered mild attacks which could easily pass unobserved. The typical chronic symptoms or even blindness can develop without the classical acute symptoms of periodic ophthalmia — conjunctivitis, increased lacrymation, photophobia and hypopyon—having been observed. In other cases, after the iridocyclitis has caused filaments and membranes to be formed in the vitreous, the first acute attack of ophthalmia is suffered. The vision has already become defective due to the vitreous opacities or other lesions of chronic ophthalmia and, in such cases, blindness often follows soon after the first acute external symptoms have disappeared. This course of ophthalmia is more common

in aged than in young horses. On some farms with a history of a high incidence of periodic ophthalmia for many years, most of the cases in aged horses have been of this type.

Chronic periodic ophthalmia can usually be diagnosed by the type of vitreous opacities and the decreased intraocular pressure. Other lesions of iridocyclitis, which are apt to be present and will aid in the diagnosis, are iritis, cataract, infiltration of the optic papilla, and detached retina.

Symptomatic iridocyclitis. — Iridocyclitis sometimes occurs in horses and mules as a concomitant of respiratory and intestinal diseases. The acute symptoms, which are clinically identical with those of so-called periodic ophthalmia, may recur and eventually cause blindness. As has been mentioned, iridocyclitis in different species and from different causes does tend to recur. It has been our observation that symptomatic iridocyclitis recurs less frequently than so-called periodic ophthalmia which, as is recognized, occurs without symptoms other than the ophthalmia.

We have observed acute iridocyclitis which could not be differentiated from an acute attack of periodic ophthalmia, in three suckling foals. In the two of these which we have been able to follow there have been no recurrent attacks for more than two years. The prognosis in these cases of symptomatic iridocyclitis should, of course, be made with some reservation. To a large extent the possibility of a recurrence depends upon the lesions remaining from the previous attack, as is true in all cases of iridocyclitis. It is therefore advisable to examine thoroughly all cases of iridocyclitis after the acute symptoms have disappeared. Such an examination has revealed lesions surprising to some who had been convinced that their treatment had produced a cure.

All the symptoms of iridocyclitis, including detached retina, can be produced from trauma. In most instances such a history is given by an owner who has been misled or who hopes to mislead the examiner. If the symptoms, whether acute or chronic, are severe, the cause may be immaterial for the end result is apt to be the same. Some evidence, such as similar lesions in the opposite eye or no symptoms of an injury in the external coverings of the eye, will often be found to support or contradict histories of trauma.

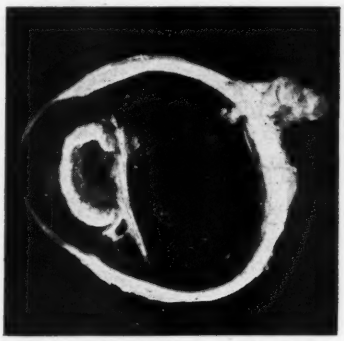


Photo by Schlotthauer

Cross section of an eye in a case of periodic ophthalmia, showing chronic destructive lesions. The fundus contained noncoagulable material; the lens has been absorbed and only the capsule remains; the retina has been pushed forward against the lens

The eyes of running horses are quite frequently injured by clods of dirt thrown by the feet of horses ahead of them. The number of cases of corneal scars from such injuries, which are accompanied by cataracts with no corneal scar or cataract in the opposite eye, suggests that cataracts develop from such contusions.

There is little difficulty in diagnosing acute iridocyclitis, although to examine the eye thoroughly it may be necessary to wait until the symptoms in the anterior structures have subsided. An eye may suffer from iridocyclitis and recover to the extent that no symptoms of ophthalmia will be evident on clinical examination. However, in periodic ophthalmia, lesions which are diagnostic of iridocyclitis usually remain. In many cases that have been considered successful recoveries from periodic ophthalmia, lesions which impair the vision and tend to cause a recurrence or a gradually diminished vision, will be found on a thorough eye examination. Lesions which impair the vision will be found also in eyes that have never suffered acute ophthalmia.

A Note on the Effect of Large Doses of Phenothiazine on Draft Horses

By L. E. BOLEY,† C. C. MORRILL† and NORMAN D. LEVINE†

Department of Animal Pathology and Hygiene
University of Illinois, Urbana, Illinois

SINCE its introduction as an anthelmintic by Harwood, Jerstad and Swanson,[1] phenothiazine has been used with success by many investigators against a number of the nematode parasites of domestic animals. As a result of the reports of Harwood, Habermann, Roberts and Hunt,[2] Taylor and Sanderson,[3] Lapage,[4] Grahame, Morgan and Sloane,[5] Knowles and Franklin,[6] Howell and Britton,[7] Errington and Westerfield,[8] Boley, Levine, Wright and Graham,[9] Britton,[10] and Habermann, Harwood and Hunt[11], it can be said that phenothiazine is very efficacious against the strongyles and cylicostomes of horses, but that it has little effect on the horse Ascaris and no effect on bots.

However, toxic effects due to the administration of phenothiazine to horses have been noted by several investigators in the past year. Errington and Westerfield[8] reported anemia, and Errington[12] observed anemia, albuminuria, and hemoglobinuria following the administration of therapeutic doses of phenothiazine to thoroughbred horses. Boley, Levine, Wright and Graham[9] reported that a reduction in blood hemoglobin occurred in some Percheron colts treated with 20gm of phenothiazine. Toynton[13] found a slight decrease in erythrocyte count in two Percherons given 72gm of phenothiazine. Hatcher[14] described a series of five deaths among 12 race horses treated with large overdoses (over 100gm) of phenothiazine. Fincher and Gibbons[15] observed two deaths and six animals with evidence of toxic effects out of 20 emaciated light horses given 15 to 50gm of phenothiazine. Folse[16] reported anemia, illness and death in race horses treated with two to four ounces of

* The authors gratefully acknowledge the suggestions of Robert Graham and Jesse Sampson in this study together with the assistance of Charles M. Wilson in the hemoglobin determinations.

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[1] Harwood, P. D., A. C. Jerstad and L. E. Swanson, 1938. The efficacy of phenothiazine for the removal of ascarids and nodular worms from swine. *Jnl. Paras.* 24, pp. 16-7.

[2] Harwood, P. D., R. T. Habermann, E. H. Roberts and W. H. Hunt, 1940. Preliminary observations on the effectiveness of crude, unconditioned phenothiazine for the removal of worms from horses. *Proc. Helm. Soc. Wash.* 7, pp. 18-20.

[3] Taylor, E. L. and K. M. Sanderson, 1940. Phenothiazine —a remarkably efficient anthelmintic. *Vet. Rec.* 52, pp. 635-647.

[4] Lapage, G., 1940. Experiments on the anthelmintic action of phenothiazine. *Vet. Rec.* 52, pp. 648-657.

[5] Grahame, T., D. O. Morgan and J. E. N. Sloane, 1940. Report on phenothiazine as an anthelmintic in horses. *Vet. Rec.* 52, pp. 660-663.

[6] Knowles, R. H. and A. V. Franklin, 1940. Treatment of equine strongylosis by phenothiazine. *Vet. Rec.* 52, pp. 663-664.

[7] Howell, C. E. and J. N. Britton, 1940. A field trial with phenothiazine as an equine anthelmintic. *Cor. Vet.* 30, pp. 526-532.

[8] Errington, B. J. and C. Westerfield, 1940. Phenothiazine as an anthelmintic for horses and mules. *Vet. Med.* 35, pp. 688-693.

[9] Boley, L. E., N. D. Levine, W. L. Wright and Robert Graham, 1941. Phenothiazine in the treatment of gastro-intestinal parasites of animals. *Ann. Rep. Ohio State Vet. Med. Assn. 1941.*

[10] Britton, J. W., 1941. Phenothiazine therapy in draft horses. *Cor. Vet.* 31, p. 85.

[11] Habermann, R. T., P. D. Harwood and W. H. Hunt, 1941. Critical tests with phenothiazine as an anthelmintic in horses. *No. Am. Vet.* 22, pp. 85-92.

[12] Errington, B. J., 1941. Phenothiazine as an equine anthelmintic. *Vet. Med.* 36, pp. 188-193.

[13] Toynton, C., 1941. Effects of phenothiazine on the equine blood picture. *Vet. Med.* 36, p. 481.

[14] Hatcher, W. L., 1941. Phenothiazine poisoning in horses. *No. Am. Vet.* 22, pp. 159-160.

[15] Fincher, M. G. and W. J. Gibbons, 1941. Phenothiazine in emaciated horses. *Cor. Vet.* 31, pp. 220-223.

[16] Folse, C. D., 1941. Phenothiazine poisoning. *Vet. Med.* 36, pp. 430-431.

phenothiazine. Finally, Wolfe and Dennis[17] fed a thoroughbred gelding 65gm of phenothiazine, and produced a hemolytic jaundice with hemoglobinuria, followed by death. Since mules and Belgian horses were treated with 90gm of the same lot of phenothiazine without ill effects, these authors concluded that the gelding had been sensitive to the drug.

On the other hand, Habermann, Harwood and Hunt[11] observed no clinical effects in three horses given 500gm of phenothiazine.

The present paper reports the effect of phenothiazine in relatively large doses on four horses.

Method

Four draft horses were treated with phenothiazine as follows:

Horse 1: 324gm in a commercial suspension by stomach tube
Horse 2: 80gm in feed (eaten readily)
Horse 3: 160gm in feed (eaten readily)
Horse 4: 400gm in feed (eaten in four days)

A series of seven hemoglobin determinations (Newcomer method) were made on horses 1, 2, and 3 previous to treatment, and starting five days after treatment hemoglobin determinations were made every other day for a month and a half. Erythrocyte counts were made also on some days.

Results

Horse 1. — Three hundred and twenty grams of phenothiazine were mixed with the feed, but this horse refused to eat the mixture, even though he was given no other feed for five days. Since it was felt that he would never eat the phenothiazine, he was fed 324gm of the drug suspended in a liquid carrier[18] by stomach tube. Pretreatment hemoglobins ranged from 8.60 to 13.05, with an average of 9.97gm per 100cc blood. Two days after treatment the hemoglobin was 12.63. However, the horse refused to eat the day after treatment, and the next day the mucous membranes appeared grayish and icteric. Three days after treatment, symptoms of colic together with reduced peristaltic sounds appeared, and the animal trembled and sweated profusely. The pulse was 90 and the temperature normal. The horse died that afternoon. At autopsy, all tissues were found to be icteric. The kidneys were greatly enlarged, weighing 8 pounds 9 ounces (the normal weight for the kidney of a horse this size is 1 pound 7 ounces). When cut, the liver and kidneys oozed blood. Gastritis and enteritis were present, the enteritis being most marked in the colon and cecum. The distal six inches of the penis contained numerous fistulous tracts (this condition had been present for some time before the administration of the phenothiazine). The inguinal lymph glands were greatly enlarged, some being four inches in diameter. The blood clots in the large vessels and heart had separated into red and white portions. Histopathologic examination of the penis revealed a squamous cell carcinoma of relatively low malignancy, with a marked tendency to "pearl" formation. Histopathologically the lungs showed rather marked passive congestion, with some hemorrhage into the alveoli. One large bronchiole was observed to be filled with blood. The small intestine exhibited passive congestion, with considerable desquamation of the surface epithelium. Mild to moderate infiltration of the mucosa with cells of the lymphoid series was present. The histopathological changes in the large intestine were similar to those in the small intestine, except that the desquamation was less marked and the cell infiltration slightly more pronounced. The kidney exhibited diffuse congestion, involving the glomeruli as well as other vessels. Many of the tubules, especially the convoluted tubules, were distended as though they were occluded further down. Many of these, and particularly many of the collecting tubules and arms of Henle's loop, were filled with cell debris (erythrocytes and polymorphonuclear leucocytes, many of the latter exhibiting karyorrhexis). Marked passive congestion was present in the liver, together with mild fatty changes and an occasional necrotic cell near the central part of the lobules. No abnormalities were observed in the heart. The spleen was

[17] Wolfe, W. R. and W. R. Dennis, 1941. Toxemia resulting from the use of phenothiazine. *Vet. Bull., Suppl. to Army Med. Bull.* 35, pp. 171-174.

[18] The authors are indebted to Jensen-Salsbery Laboratories, Inc. for furnishing the phenothiazine in liquid form and to Abbott Laboratories for the powdered phenothiazine used in this experiment.

heavily laden with erythrocytes and with hematogenous pigment.

Horse 2.—Pretreatment hemoglobin levels ranged from 8.90 to 15.60, with an average of

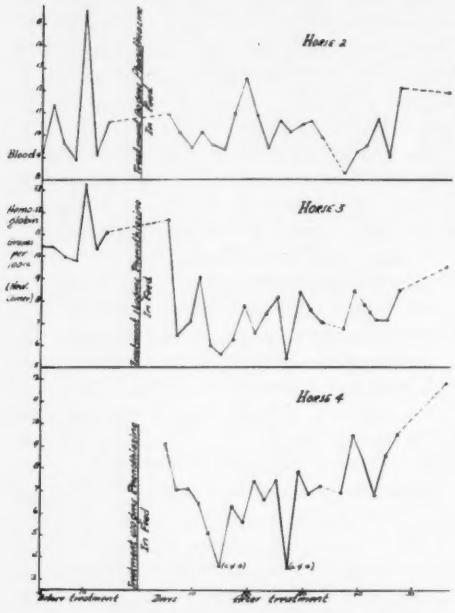


Fig. 1. Pre- and post-treatment hemoglobin levels of three of the experimental animals

9.24gm per 100cc blood (Fig. 1). Eighty grams of phenothiazine were mixed with the feed and eaten readily. Five days after treatment the blood hemoglobin was 10.90, and for the next month and a half it varied from 8.26 to 12.51, with an average of 10.23gm per 100cc (Fig. 1). Thus no decrease in blood hemoglobin occurred. Post-treatment erythrocyte counts varied from 5,830,000 to 7,090,000 per cubic millimeter, and roughly paralleled the hemoglobin levels. Four pretreatment urine analyses were negative to sugar, albumin, ketones, blood, and bile salts, and an examination one week after treatment was negative also.

Horse 3.—Pretreatment hemoglobin levels ranged from 9.87 to 13.05, with an average of 10.67gm per 100cc blood (Fig. 1). One hundred and sixty grams of phenothiazine were mixed with the feed and eaten readily. Five days after treatment the blood hemoglobin was 11.59, but two days later it had dropped to 6.47gm per 100cc. Thereafter for the next month and a half it varied between 5.42 and 8.42, with an average of 7.22gm per 100cc (Fig. 1). Thus, a significant decrease in blood hemoglobin occurred. Erythrocyte counts made from seven to 33 days after treatment ranged from 4,000,000 to 5,300,000 per cubic millimeter, and roughly paralleled the hemoglobin levels. Three pretreatment urine analyses were negative to sugar, albumin, ketones, blood, and bile salts, but albumin and a small amount of sugar were found in a fourth pretreatment examination. One week after treatment the urinalysis was again negative.

Horse 4.—No pretreatment blood studies were made on this animal. Four hundred grams of phenothiazine were mixed with the feed, and eaten over a period of four days. Five days after treatment the blood hemoglobin was 9.02, and two days later it was 7.05. For the next month and a half it varied between less than 4.00 and 9.50, finally, 56 days after treatment, reaching 11.82gm per 100cc (Fig. 1). The average post-treatment hemoglobin was less than 7.24. These figures indicate a reduction in blood hemoglobin, even though no pretreatment values were obtained. Post-treatment erythrocyte counts varied from 2,750,000 to 4,660,000 per cubic millimeter, and roughly paralleled the hemoglobin levels. Three pretreatment urine analyses were negative to sugar, albumin, ketones, blood, and bile salts. However, one week after treatment, albumin and a small amount of sugar were found.

Discussion

Although the present experiment was carried out on only four horses, certain interesting facts appear. No effect was obtained in a Percheron horse by feeding 80gm of phenothiazine, but 160gm and 400gm respectively produced an anemia in two others. No significance can be attached to the appearance of sugar and albumin in horse 4 after treatment, since they occurred in horse 3 before treatment but after three previous negative examinations.

Two factors must be considered with reference to the death of horse 1 after admin-

istration of 324gm of phenothiazine. First, at the time of treatment he was suffering from carcinoma of the penis, which may have interfered with the normal elimination of urine, and hence with the elimination of phenothiazine in the urine. It is possible that the evidence of stasis noted in the kidney tubules on histopathologic examination may have been associated with the carcinoma of the penis rather than with the effect of phenothiazine. On the other hand, Hatcher[14] observed greatly enlarged kidneys at the autopsy of one horse which died following treatment with phenothiazine and Wolf and Dennis[17] found that the heart, liver, spleen and kidneys of the gelding which they autopsied were enlarged, the heart and kidneys being at least twice normal size. The kidneys of horse 1 in our own study were also greatly enlarged. Hatcher made no histopathological study, but Wolfe and Dennis reported rather abundant debris and occasional red cells in the glomeruli and tubules. A slight diffuse monocytoid reaction was present in the kidney connective tissue. Further observations on the histopathology of phenothiazine poisoning in horses and other animals would be valuable.

A second factor which must be considered is that this animal had not eaten for five days before treatment, and hence was probably not in good condition at that time. Thus his general condition and the carcinoma of the penis might both have made the horse less resistant to phenothiazine than he would otherwise have been. On the other hand, of course, he might have died even if he had had neither condition.

Probably the most interesting observation is the great variability in hemoglobin level which was encountered. Since the Newcomer method of hemoglobin determination involves the use of the eye in comparing intensity in the colorimeter, it might be considered that the variability was due to subjective differences in the operators. To eliminate this human factor as much as possible, one person made all determinations. Moreover, a comparison of the results obtained by the Newcomer method with those obtained by the use of a photoelectric colorimeter (to be published) indicate that the observed variations in hemoglobin level are not due to the technic employed or to the operator but to actual variations in the horses themselves.

In the 21 hemoglobin determinations made at two-day intervals before treatment on horses 1, 2 and 3, differences of from 0.00 to 6.70gm per 100cc of blood were observed from one reading to the next. The average difference between consecutive readings was 2.13gm per 100cc. This finding indicates that single determinations are of relatively little value in studying changes in hemoglobin due to phenothiazine or other agents. Moreover, small changes cannot be considered significant. If the averages of a sufficient number of determinations are used, however, the results become more significant. Probably seven consecutive determinations are sufficient to establish a base level. The observations presented herein must be considered as only preliminary, and further careful study is necessary to determine the extent and cause of diurnal variation in blood hemoglobin in the horse.[19]

Summary

In a study of the effect of phenothiazine upon Percheron horses, no significant change was found in the urine or blood hemoglobin of one animal fed 80gm. The blood hemoglobins of two horses fed 160 and 400gm, respectively, were lowered, but no significant change in the urine constituents was observed. One horse with carcinoma of the penis which had been fasted for five days died three days after being fed 324gm of phenothiazine.

A marked variation, averaging 2.13gm per 100cc of blood, was observed in the blood hemoglobins of untreated horses from one bleeding to the next, and the consequent necessity for repeated rather than single determinations in a study of the effect of phenothiazine on the blood hemoglobin was indicated.

[19] Just as this paper was submitted for publication, the report of Schmidt, Christian and Smotherman (*J.A.V.M.A.* 99:225) appeared, in which they described several deaths among thoroughbred horses treated with phenothiazine, and observed anemia and kidney damage. Toxic symptoms and deaths due to the therapeutic use of phenothiazine reported in the literature have occurred in most cases in thoroughbred and saddle horses, and it is possible that these lighter breeds may be more sensitive to the same dosage per unit body weight than are draft horses. However, the possibility of an idiosyncrasy to the drug in certain individual horses cannot be excluded.

Effect of Sulfanilamide and Sulfapyridine on Antibody Formation

By MARCUS M. MASON
Putnam, Connecticut

THE discovery of the many therapeutic uses of sulfanilamide and related compounds has given impetus to a tremendous amount of research into the mechanism and pharmacology of this group of drugs.

Soon after its discovery as a therapeutic agent, Gay and his associates[1] made extensive studies into the mode of action of sulfanilamide on the streptococci and found the drug to be bacteriostatic but not bactericidal—in fact, it did not even impair the innate virulence of the organisms.

More recently, it has been found that the efficacy of sulfanilamide is to be explained on the basis of its similarity to the bacterial enzyme p-aminobenzoic acid, the drug acting as a block in the metabolism of the streptococci by substituting for the enzyme. Since some organisms have or can acquire the property of drug fastness, this metabolic block may be only temporary, and some additional therapy may be necessary to assure complete bacteriostasis.

Fleming,[2] working with mixtures of organisms, drugs and blood, found that sulfanilamide was antileucocytic only in dilutions of 1:400 or stronger, which is a greater concentration than can ever be attained in the blood stream. The same general principle held true for sulfapyridine.

De and Basu,[3] Finland and Brown,[4] Lowenthal,[5] Bourne,[6] and many others have reported that in both streptococcal and pneumococcal infections, there seems to be an increased value when the therapy consists of the use of combination of immune sera and one of the sulfonamide compounds.

Maclean, Rogers and Fleming[7] began work on the assumption that if the drugs were merely bacteriostatic, it would be necessary for the patient to have or develop specific antibodies to destroy the quiescent organisms. They came to recommend the immediate use of vaccines, delaying administration of the drug until the eighth day and then continuing it for three weeks.

Cokkins and McElligott[8] had observed this phenomenon in their treatment of gonorrhea during 1938, writing, "Unless arrested bacteria are dealt with by the immunity mechanism, relapse occurs when chemotherapy is discontinued." According to their analysis the best time to start chemotherapy is the 8th to 10th day of the disease. At this time, the antibodies can be demonstrated by the complement fixation test.

Finland, Spring and Lowell[9] studied the formation of antibodies in pneumonia patients who were being treated with sulfapyridine. They found the antigen-antibody reaction to be independent of the action of the drug on the organism. The greatest and most rapid bactericidal activity was found in the presence of the heat-stable antibodies. It was noted that the drug action was "delayed" as compared with the rapid action of the specific immune bodies. The action of the two was not synergistic, but seemed to be complementary, and recoveries were more complete when both were present until recovery was well under way.

Along with the many favorable reports, there cropped up reports of nausea, vomiting, hematuria, leucopenia, and agranulocytosis after continued use of the drug. Toomey[10] reported urinary concretions and warned against the use of the drug in cases where nephritis or urinary retention was a complication. Coxon and Forbes[11] reported the occurrence of agranulocytosis. Reynolds

[1] Gay, F. P., and A. R. Clark, 1937. *Jnl. Exp. Med.* 66, p. 535.
[2] Fleming, A., 1939. *Proc. Roy. Soc. Med.* 69, p. 607.
[3] De and Basu, 1938. *Brit. Med. Jnl.* 2, p. 564.
[4] Finland and Brown, 1939. *Jnl. Clin. Inv.* 17, p. 307.
[5] Lowenthal, H., 1939. *Lancet* 1, p. 197.
[6] Bourne, A. W., 1939. *Proc. Roy. Soc. Med.* 32, p. 911.
[7] Maclean, Rogers and Fleming, 1939. *Lancet* 1, p. 562.
[8] Cokkins and McElligott, 1938. *Lancet*, p. 355.
[9] Finland, Spring, and Lowell, 1940. *Jnl. Clin. Inv.* 19, pp. 179-199.
[10] Toomey, J. A., 1939. *J.A.M.A.* 113, p. 250.

and Slobody[12] reported leucopenia in children.

The apparent synergistic action of the drugs with immune sera and the apparent injury done by the drug to the vascular system led to the present work, in an effort to determine whether specific antibody formation could be induced in an animal while it was under the effects of full therapeutic doses of the drug. There had been numerous studies made showing that in long continued cases antibodies would finally develop, but nowhere had the study been put on a quantitative basis.

TABLE I.

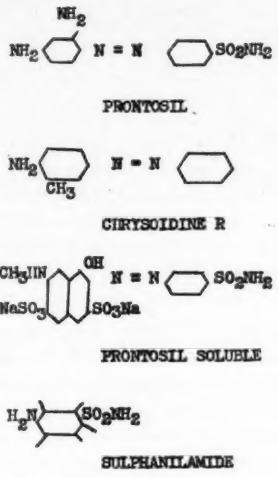
Treatment	No. of rabbits	Average weight per rabbit	Amount of drug used Daily dose	Total dose
Sulfapyridine	9	9.8 lbs.	2.5cc	35gm
Sulfanilamide	9	9.4 lbs.	2.5cc	35gm
Control	9	7.9 lbs.	None	None

In this experiment, 27 rabbits were immunized with pneumococcus Type I vaccine. Nine of the animals were given daily oral doses of sulfanilamide, and nine similar doses of sulfapyridine, in approximately the same dosage per pound of body weight as that recommended for humans. The other nine rabbits served as controls. Blood samples from each group were compared as to antibody content, and the average weight of each group was determined at intervals as a measure of toxicity.

The average weight of the animals in each group at the start of the experiment and the amount of the drugs administered are shown in Table I. Both the sulfanilamide and the sulfapyridine were administered as emulsions composed of bland oils containing 20% of the drug. Several composite samples of blood revealed the presence of the drug if the samples were taken soon after dosing; as long as 16 hours after dosing, no traces of the drug could be found.

The experiment was continued for ten weeks. Two small heart blood samples were taken during the immunization period and three after the five cycles of injection. The blood from all the rabbits in a group was pooled and samples taken from the pool for a volumetric test.

The volumetric test involves the precipi-



Medical history was made when a relatively simple compound which had been known to organic chemists for 30 years found its way into medicinal use — first as a component of the more complicated azo dyes, then as an independent compound. Domagk was responsible for the development of prontosil, patented in 1935. More soluble and less toxic forms were quickly developed, and it was found that the azo linkage was unnecessary to their antistreptococcic effect; that sulfanilamide itself was the active principle. Since that time myriads of therapeutic uses have been found for members of the sulfonamide group, and a tremendous amount of research on them has been carried out.

[11] Coxon and Forbes. 1938. *Lancet* 2, p. 1412.
[12] Reynolds and Slobody. 1939. *Arch. of Ped.* 56, p. 415.

tation of specific polysaccharide when it comes in contact with the specific antisera. The precipitate is measured in a graduated centrifuge tube and is compared with serum

TABLE II.

Treatment	Potency in mouse units of antibody 4th Week	5th Week	6th Week	8th Week	10th Week	Average
Sulfapyridine	525	820	865	730	730	734
Sulfanilamide	430	275	725	910	820	632
Control	380	635	910	870	545	668

that has been mouse tested to determine mouse units of antibody. Since the volumetric test may vary as much as 10%, differences of less than 10% are not significant. It will be noted that the average potencies of the three groups, shown in Table II, vary less than 10% from the mean.

The rabbits were weighed every two weeks. In no case was there any marked decrease in the average weight; in fact, the group of rabbits on sulfapyridine gained 12% in weight. (Average weight is a better indication of toxicity in this experiment than death, since many of the casualties were due to the bleeding from the heart rather than to the effects of the drug.) The average weights of the animals at the beginning and at the end of the experiment are shown in Table III.

Discussion

Recently work has been carried out to show the correlation between the activity of the leucocytes and the production of demonstrable antibodies. In the experiments of Fleming[2] and in those reported here it is noteworthy that following the administration of sulfanilamide or sulfapyridine there was no appreciable evidence of leucocytic damage or injury to the reticulo-endothelial system. Powell and Chen[13] noticed a fluctuation in the number of leucocytes, but to no greater extent than in control groups. In cases where leucopenia or agranulocytosis has occurred following the administration of sulfanilamide or sulfapyridine, it is possible that the cause was not the drug.

Molitor and Robinson[14] have shown that large doses of sulfanilamide will kill and that smaller doses will induce a loss of weight; but within the limits of the therapeutic doses there is no significant damage. Johannsen and St. George[15] fed mice up to 50 times the therapeutic dose for 10 days without ill effects.

In our experiments, carried over a period

TABLE III.

Treatment	Rabbits started	Rabbits surviving after 10 weeks	Average weight Beginning	End	% gain or loss
Sulfapyridine	9	5	9.8 lbs.	10.9 lbs.	Gain 12%
Sulfanilamide	9	7	9.4 lbs.	9.1 lbs.	Loss 3%
Control	9	1	7.9 lbs.	8.0 lbs.	Gain 1%

of 10 weeks, there were no gastric disturbances, no significant loss of weight, and no appreciable difference in antibody formation during the administration of sulfanilamide or sulfapyridine.

The proposed use of a combination of vaccines and chemotherapy, advocated by Fleming and his co-workers, is extremely interesting and worthy of development. De Schmidt[16] has worked out a method of producing an autogenous vaccine rapidly. It is obvious that in some cases of pneumonia, streptococcal or gonococcal infection it is sometimes easier to make a vaccine than it is to identify and type the organism and then obtain specific antiserum.

Recently, Barto[17] has combined sulfathiazole with small repeated doses of staphylococcus toxoid or vaccine in the treatment of small animals. He has recorded excellent results in such varied conditions as leucorrhea, pedal furunculosis, catarrhal otorrhea, skin ulcers and eczema.

The use of vaccine therapy as an adjuvant to drug therapy can be useful also in cutting down the number of recurrent infections.

Conclusion

Antibodies can be produced in fairly high titre while experimental animals are under full therapeutic doses of sulfapyridine or sulfanilamide.

[13] Powell and Chen, 1939. *Jnl. Pharm. and Exp. Ther.* 67, p. 79.

[14] Molitor and Robinson, 1939. *Jnl. Pharm. and Exp. Ther.* 65, p. 405.

[15] Johannsen and St. George, 1939. *Am. Jnl. Clin. Path.* 9, p. 414.

[16] De Schmidt, F. P., 1938. *Brit. Med. Jnl.*, p. 1140.

[17] Barto, L. R., 1941. *J.A.V.M.A.* 98, p. 152.

A Note on the Effect of Repeated Doses of Phenothiazine on Sheep*

By WILSON L. WRIGHT

Department of Animal Pathology and Hygiene
University of Illinois, Urbana, Illinois

SINCE Harwood, Habermann and Jerstad[1] first reported the efficacy of phenothiazine against sheep nematodes, this drug has been used with success against sheep stomach worms and nodular worms by many investigators. No toxic manifestations have been reported in this animal aside from occasional constipation. However, it was found by Errington and Westerfield[2] that phenothiazine may cause anemia in some horses, and other reports have confirmed their observation (cf. Boley, Morrill and Levine,[3] for a brief review of this subject). Symptoms of incoordination have been observed by Lapage[4] in swine treated with phenothiazine while an unreported incident of phenothiazine poisoning in pigs has recently come to the attention of the Illinois Agricultural Experiment Station. In view of these reports and since no thorough study of the changes in the blood hemoglobin in sheep following phenothiazine treatment have been published, it was felt worth while to determine the effect of repeated doses of phenothiazine on the blood hemoglobin of sheep.

In this study, nine native yearling lambs were used. They were divided into three lots of three lambs each. The lambs in Lot 1 were each given a single dose of 25gm phenothiazine by capsule, those in Lot 2 were given 25gm each weekly for six weeks, while the lambs in Lot 3 were untreated controls. Weights, blood hemoglobins (Newcomer method), and urinary examinations for albumin, ketones, bile salts, blood, and sugar were made before treatment and weekly during the treatment period.

The phenothiazine treatments had no effect on gain in weight, and neither albumin, ketones, bile salts, blood nor sugar were found in the urine at any time.

The average blood hemoglobin over the nine-week test period of the lambs in Lot 1 (which had received a single dose of 25gm phenothiazine each) was 10.01gm per 100cc of blood. That of the lambs in Lot 2 (which had received 25gm phenothiazine weekly for six weeks) was 9.42gm, while that of the control lambs in Lot 3 was 9.65gm. No significant variations in blood hemoglobin were observed in any of the lambs during the course of the experiment. It can be concluded that treatment with phenothiazine as indicated above had no depressing effect on the blood hemoglobin level in these lambs.

Summary

A single 25gm dose of phenothiazine and six weekly 25gm doses were found to be without effect on the blood hemoglobins and weight gains of yearling lambs, and to cause no pathologic constituents to appear in the urine.

* An abstract of a research report prepared under the direction of the Division of Animal Pathology and Hygiene in partial fulfilment of the requirements for the M.S. degree in Animal Husbandry. The author is indebted to Drs. Robert Graham, Jesse Sampson, Norman D. Levine, and L. E. Boley for suggestions and criticisms.

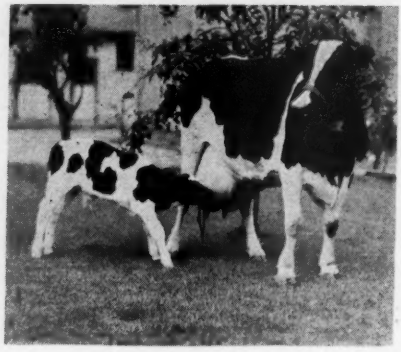
[1] Harwood, P. D., R. T. Habermann and A. C. Jerstad, 1939. Efficacy of commercial phenothiazine in the removal of roundworms from sheep. *Vet. Med.* 34, pp. 440-443.

[2] Errington, B. J. and C. Westerfield, 1940. Phenothiazine as an anthelmintic for horses and mules. *Vet. Med.* 35, pp. 688-693.

[3] Boley, L. E., C. C. Morrill and N. D. Levine, 1941. A note on the effect of large doses of phenothiazine on draft horses. *Vet. Med.* 36, pp. .....

[4] Lapage, G., 1940. Experiments on the anthelmintic action of phenothiazine. *Vet. Rec.* 52, pp. 648-657.

Some Factors Affecting the Incidence of Calf Scours*



By W. T. S. THORP, J. F. SHIGLEY and M. A. FARREL

Pennsylvania Agricultural Experiment Station
State College, Pennsylvania

THIS report is a summary of observations made over a 2½ year period on a large dairy herd where calf scours was a serious problem. Hagan[1] reported scours and pneumonia in calves from which coliform organisms were isolated as the possible causative agent. Smith and Little[2] made an extensive study of the digestive tract of the young calf. Smith and Orcutt[3] made a bacteriological study of the digestive tract of the calf. They found that colostrum lowered the morbidity due to *Bacillus coli* septicemia but that calves may develop scours due to the local increase of *B. coli*. They also found that a delicate balance exists between the mucous membranes of the digestive tract and certain strains of *B. coli* which may cause scours. The following statement is also made: "The necessary conditions for such attacks are in part inherited defects of the digestive tract, both morphological and functional, and special types of *B. coli*, resident in the herd environment."

Predisposing Factors

In a group of 15 calves allowed to nurse the dam at will for three to four days, typical calf scours developed in 12 of the calves, with a 25% mortality. In another group of 21 calves which were taken from the dam after the first 24 hours, typical scours developed in six calves, with only one case terminating fatally. This would indicate that where scours is very prevalent in a herd there is a lower morbidity and mortality where the amount of dam's milk is regulated after the calf is a day old. Calves handled this way were given four to six pounds of the dam's milk per day. The calves from the better or higher producing cows showed a greater tendency to develop scours.

Pathology

The calves succumbing to scours were from two to four days old. A very thin, watery, sometimes bloody diarrhea developed in most cases in calves one to two days old. In 12 of the 15 cases studied bacteriologically, nervous symptoms were noted just before or immediately after the onset of diarrhea. Upon necropsy of the very acutely affected animals, the small intestine was highly inflamed, with an occasional large hemorrhagic area one to two centimeters in diameter. In all four calves which came to necropsy from the group allowed to nurse the dam at will, one or more large masses of coagulated milk were noted in the rumen. These were usually three to five inches in diameter, and sometimes as many as several occurred in one calf. This was not observed in calves in which the milk was regulated.

Sections from the intestines showed a very acute hemorrhagic enteritis with much desquamation of the epithelium. In numerous areas thrombosis of the intestinal blood vessels was observed. In one case of scours the calf died of later complications consisting of thrombosis of the smaller coronary arteries and a resulting degeneration of the myocardium. Degenerative and inflammatory changes in the kidney and liver were also observed in this case.

* Authorized for publication as Paper No. 1045 in the journal series, Pennsylvania Agricultural Experiment Station.

[1] Hagan, W. A., 1917. The etiology and mode of infection in white scours of calves. *Cor. Vet.* 8, p. 263.

[2] Smith, T. and R. B. Little, 1923. *Jnl. Exp. Med.* 37, p. 671.

[3] Smith, T. and M. L. Orcutt, 1925. *Jnl. Exp. Med.* 41, p. 89.

Bacteriology

On the basis of the cultural, morphological and biochemical reactions, the 125 cultures isolated from the 15 animals considered here were mostly of the coliform group. Table I indicates the source of the organisms and the distribution of the various types.

Table I. Source and Distribution of the Organisms Isolated from 15 Cases of Acute Calf Scours

Bacteria Isolated	Spleen	Liver	Kidney	Heart Blood	Brain	Mesenteric Lymph Node
Coliform Group	10 cases	9 cases	11 cases	15 cases	12 cases	15 cases
Hemolytic Streptococci	None	None	1 case	3 cases	1 case	3 cases
Non-Hemolytic Streptococci	1 case	None	2 cases	9 cases	4 cases	2 cases

Thirteen of these calves were killed just before death and examined immediately. The other two were examined immediately after death. The four cases in which a non-hemolytic streptococcus was isolated from the brain showed definite nervous symptoms early in the course of the disease.

Prevention and Treatment

The treatment of calf scours with drugs has met with varied success. Bismo-pepsol 2 to 3 oz., and aromatic spirits of ammonia ½ oz., were used in conjunction with serum as a treatment in 24 calves, with varying results. The use of calf scour serum in herds where the disease is a persistent problem has not always met with favorable results. This is especially true where serum is used as a means of treatment after the syndrome has become established. The use of commercial sera met with little success in these cases. A more specific serum was made by immunizing cows with three strains of the coliform group of organisms recently isolated from cases of acute calf scours. The serum thus produced gave better protection as a routine procedure at birth and was far better when used in the course of treatment. This procedure is similar to that followed by the Dairy Husbandry Division at Beltsville, Maryland.[4] Since the severe losses in newborn calves have been eliminated, we have been using commercial sera of bovine origin as a prophylactic injection in day-old calves, with good results to date. Cases that develop after the calf is a week to ten days old yield to chemotherapy much more readily than do those occurring in the young calf.

Summary

1. Observations on the cases of calf scours among 362 calves over a 2½ year period are reported.

2. Our experience indicates that where calf scours is a serious problem in a high producing herd, the regulation of the intake of the dam's milk tends to reduce the incidence and severity of the syndrome.

3. A specific serum was necessary to check the severe outbreak encountered here. After the scours had been brought under control, the routine use of commercial sera at birth gave satisfactory results.

4. The medicinal treatment of calves two to three days old was not highly successful where a large number of calves were affected. Medicinal treatment of calves over a week old has proved more satisfactory.

Septicemic affections of the newborn, practically unknown in animals on free range, are found wherever domesticated mammals are bred. These are caused by facultative pathogenic bacteria occurring widely in nature and are therefore difficult to control. Proper feeding of the dams and strict cleanliness during and after parturition are important prophylactic measures. Other factors in the control of calf scours in a dairy herd are discussed above.

[4] Report of the Chief of The Bureau of Dairy Industry, 1939, p. 7 and 1940, p. 12.

Hypoglycemia in Newly Born Pigs —Baby Pig Disease

DURING the past eight years sporadic outbreaks of a highly fatal disease of newly born pigs have come to the attention of the Illinois Agricultural Experiment Station. This, or an indistinguishable malady, has been arbitrarily referred to as baby pig disease. In connection with different outbreaks on widely separated farms, an increasing number of naturally affected pigs have been delivered to the laboratory for examination, while a limited number of affected herds have been inspected to observe methods of managing the pregnant sows. The extent of the loss in 25 herds ranged from one to twenty-two litters, representing from 5 to 95% of the pigs farrowed during a single farrowing season. Litters from both sows and gilts have suffered losses. A large number of sows and gilts with affected pigs have been rebred and have farrowed healthy litters.

Symptoms

In the typical syndrome, apparently normal pigs varying from approximately 24 to 72 hours old or slightly older show symptoms of shivering, dullness and anorexia. The pigs have a tendency to isolate themselves and burrow under the bedding. Frequently, when disturbed, they omit a weak crying squeal. Coincident with the loss of appetite and onset of weakness, the hair coat becomes rough, the skin cold and clammy, and the heart action slow and feeble. The body temperature is normal, becoming subnormal in the terminal stage. Finally, the affected pigs lapse into coma. Death of several or all pigs in the litter often occurs within 24 to 36 hours after the first symptoms are manifested. In one herd, several litters showing typical symptoms succumbed, while several surviving unthrifty pigs three to four weeks old showed low blood sugar levels associated with lesions of facial necrotic dermatitis. A number of these pigs made satisfactory recoveries when fed milk.

Gross Pathology

No characteristic gross pathologic changes have been observed at autopsy. The liver in some pigs is yellow, but more often the organ is congested and of a dark red color. The frequent observation of a large mass of curdled milk in the stomachs of affected pigs has been accepted as presumptive evidence of gastrointestinal stasis. On the other hand, the absence of milk in the stomachs of some pigs suggests that these pigs had not nursed, or nursed only to a limited extent between the time of birth and the onset of symptoms.

Etiology

Repeated efforts have been made to demonstrate in the tissues the presence of pathogenic agents, such as bacteria, filtrable viruses, protozoa and toxins. The results proved negative. Likewise, the stomachs and intestinal contents of affected pigs as well as the milk of sows with affected litters have been examined for the presence of toxins, with negative results. In all herds sequelae of such diseases as hog cholera, influenza, erysipelas, and enteric disorders have been quite definitely eliminated as etiological factors.

The state of nutrition of the sows and the gilts in the outbreaks studied was usually good and in some instances the owners were inclined to believe that the high condition of the sows at farrowing time might be associated in some way with the etiology. With few exceptions, the sows and gilts with affected late winter or spring litters were fed rations that included yellow corn, a protein supplement consisting of tankage and soybean oil meal, and either a simple or a complex mineral mixture. Oats, and in some cases wheat by-products, formed a basic part of the ration. Sows and gilts farrowing fall litters that developed the disease usually had access to legume or blue grass pasture. The syndrome does not, therefore, appear to be the result of a nutritional deficiency of qualitative origin; but on the basis of laboratory investigations may bear an indirect relationship to the quantity of feed consumed by the sow or gilt during the last few weeks of pregnancy. This and many other phases of the problem merit further study.

Spontaneous Hypoglycemia

No significant abnormalities have been found in the constituents of the urine and blood of pigs in affected litters with the exception of the blood sugar. Additional data are desirable, however, before definite conclusions can be reached with respect to the other blood constituents. The range of blood sugar for 23 pigs from 10 litters affected with so-called baby pig disease representing eight distinct outbreaks, was found to be from 3.29mg to 61.02mg per 100cc, with an average of 24.83mg. The blood sugar for 39 normal pigs from five litters farrowed by sows fed approximately one and three-fourths pounds of concentrates per cwt. daily during pregnancy was 75.58mg to 149.16mg per 100cc, with an average of 114.51mg. These litters were approximately 12 to 48 hours old when blood was collected for analysis.

Aside from its other nutritive values, pork ranks high as a source of vitamin B_1, the "morale vitamin," and therefore takes on an added importance at a time of national emergency. Together with the unremitting fight against hog cholera, swine erysipelas, hemorrhagic dysentery, and other serious disease threats to the swine industry, the systematic investigation and control of all other conditions which cut down pork production are a part of the responsibility of the veterinary profession in the national defense program

Experimental Hypoglycemia

A marked susceptibility of the newly born pig has been observed to the development of an acute fasting hypoglycemia during the first 12 hours of life, and a striking refractoriness of litter mates at 120 to 140 hours interrupted fasting. It is not inferred from old to the development of acute hypoglycemia when subjected to a fasting trial. In illustration, seven newly born pigs from three litters were allowed to nurse until they were from approximately 120 to 140 hours old. They were then placed on a complete fast for from six to seven days. At the end of these trials, the range and the average for the blood sugar concentration in these pigs was found to be lower than at the beginning of the fasting period, but well above the danger level. The pre-fasting average for the blood sugar was 122.36mg per 100cc and the post-fasting average, 84.75mg per 100cc of blood. Furthermore, although there was a very obvious decrease in the weight of all pigs, they did not develop symptoms characteristic of acute hypoglycemia, such as drowsiness and coma, but remained active and fairly vigorous throughout the 140 to 170 hours of un-

these observations, however, that an acute hypoglycemia might not develop in older pigs if subjected to prolonged starvation.

Prophylaxis

Since all the factors responsible for the occurrence of spontaneous hypoglycemia in newly born pigs have not been established, it is not possible as yet to prescribe complete measures of prevention. Nevertheless the following precautionary measures appear to be worthy of consideration.

1. A liberal grain ration should be fed to the sows and gilts during pregnancy, particularly during the last few weeks of gestation. The common practice of drastically reducing the amount of concentrates fed during the last week or ten days of pregnancy may prove to be an unwise procedure, as developing pigs *in utero* require increasing amounts of essential nutrients. Furthermore, a prompt and sustained flow of milk is essential to the newborn pig.

2. During the first 72 hours newly born pigs should be watched carefully for symptoms of inappetence, rough hair coat, loss of condition, and decreased vigor. If symptoms appear, the pigs should be fed by hand, although caution should be exercised to prevent scours which may result from overfeeding. Precautions should also be taken to prevent chilling of pigs.

3. If the sow does not appear to have an adequate flow of milk when given a liberal ration of concentrates and free access to a wholesome supply of water, the use of a galactagogue such as pituitary extract (anterior lobe) may be tried. Agalactia may also be associated with metritis, mastitis, and other post-parturient disorders.

Treatment

In the early stages of the disease (precoma), intraperitoneal injections of glucose solution supplemented by frequent feedings of sugar solution or milk may be expected to result in a fairly high percentage of recoveries. The optimum strength and the amount of glucose solution for affected pigs have not been determined. The administration of a sterilized 40% solution in 5 to 10cc doses has been quite effective when distributed over a 24-hour period. Hand feeding should also be spread over a 24-hour period and usually does not have to be continued longer than three or four days. Baby pigs soon learn to drink milk from a shallow pan or trough.—*From the Division of Animal Pathology and Hygiene, University of Illinois.*

[COMMENT: The observations recorded concerning a little-understood malady that levies an enormous annual toll on the swine industry are very valuable and add considerably to the sum total of knowledge on the subject. However, acceptance of the authors' conclusions as to the causes of the malady will probably be withheld by many since it is apparent that, as the authors state, "This and many other phases of the problem merit further study." The explanation that a healthy sow in good flesh does not supply sufficient milk to nourish her young because of the quality of the ration during the latter weeks of pregnancy requires a good bit of demonstration. Common experience in swine husbandry is that high feeding of the sow right up to farrowing time is disastrous to the litter. It is more likely that there is a cause other than inanition for the agalactia which is increasing in frequency throughout the corn belt. The possibility of inheritance should be explored, if, as the authors' observations imply, the syndrome is not due to a qualitative nutritional deficiency as others have thought.]

Pronounced Chronic Swine Erysipelas

In discussing the intermediate stage of an attack of swine erysipelas and the chronic stage which develops from the intermediate stage, Dr. T. W. Munce,[1] of Sioux City, Iowa, stated:

"The intermediate stage of swine erysipelas is characterized by extreme weakness and prostration. The hogs are usually found lying on their sides. If lifted, they collapse and remain in any unnatural position in which they fall. If they are able to walk, the gait is stiff and stilted. Inappetence is complete. The temperature continues to rise to 107° F., or higher. Stocking of the legs is frequently observed as well as swelling of the skin on the ears, eyelids, and snout. The skin of the abdomen, axilla and other thinly covered portions of the body may assume a red or purplish-red color. The skin of the shoulders, back or sides may reveal infiltrated or thickened areas varying in size from those resembling insect bites to those involving the entire back.

"Arthritis involving one or more joints of the legs may be noted. Most of the deaths during this stage (fourth to tenth day of illness) occur near its conclusion. The surviving animals either recover or convalesce to the chronic stage.

"In the chronic form or chronic stage of swine erysipelas, the temperature usually returns to approximately normal. The affected animals regain some strength, but they are quickly exhausted by forced exercise. They are frequently found lying on the sternum or sitting upright to facilitate respiration. The appetite may improve for a time and then decline. Labored breathing and a chronic cough are frequently observed. Arthritis and gangrenous processes involving the ears, snout, tail or skin of the back or sides are not common.

"The chronic stage or form of swine erysipelas is characterized by a variety of secondary developments and complications. Therefore, a great variety of symptoms may be observed. Many of the deaths which occur during that stage most probably are caused by complications such as pneumonia, enteritis, carditis, hepatitis, etc., rather than by the swine erysipelas organism.

"The lesions in this stage depend upon the complications present. Thus we may find pneumonia, enteritis, carditis, etc. Those lesions which if present possess the greatest diagnostic value include arthritis, gangrenous processes of the skin, ears and tail and a cauliflower-like deposit of fibrin or fibrous tissue on a valve of the heart. This last lesion is not diagnostic but its presence is at least suggestive.

This hog, nearly a year old when the picture was taken, became infected with swine erysipelas at three months of age. At first the joints were swollen and apparently painful as it had difficulty in walking and was reluctant to put the weight of its body on either foot. Gradually the soreness gave way to stiffness and later to hard, permanently enlarged joints and the characteristic arched back of chronic erysipelas. Early treatment of a herd with erysipelas serum and culture, the culture alone repeated in 14 days, appears to arrest this type of erysipelas in many cases. Treatment of baby pigs, even one day old, with serum and culture is helpful in control of the disease and prevention of chronic cases

"In this stage many of the internal organs show evidence of chronic inflammatory changes; they are frequently subnormal in size and firm in consistency. The serous surfaces of the abdominal organs may reveal a pronounced roughened appearance due to deposits of shreds of fibrous tissue. Gross changes are frequently found in the lungs during this stage—their surface may be studded with pin-head to pea-sized hemorrhages. They also may reveal edematous infiltration or pneumonia of various types and extent."

[1] At the annual meeting of the Indiana Veterinary Medical Association, Indianapolis, Jan. 14-16, 1941.

A Small Animal Practitioner's Day

By H. W. YOUNG, Kansas City, Missouri

JUST as I am turning over in bed and gloating over the prospect of another hour of sleep (for yesterday's work extended far into the wee small hours), the telephone rings. Wearily picking up the receiver, I hear: "Hello, Doctor, what time will you be in your office? My husband has to be at work by seven, and he wants to bring our dog over for you to see first. Something seems to be wrong with him. He has been vomiting for three or four days, and isn't able to retain anything, either food or water."

I reply that my office hours begin at 8 a.m., but that if necessary I can be there earlier. The answer comes—"My husband is leaving now, and will be at the hospital in about 15 minutes."

Reluctantly I arise, dress, inform the Mrs. I will not be back for breakfast, and hurry off to meet the early client.

At the office, only a minute away, I greet the hospital force with the usual morning salutations and questions. How is everything and everybody? My first morning duty is to check the wards and see for myself that "all is well." Fifteen years of experience have taught me that in order to know everything one needs to know about one's patients, at least part of the information must be obtained first-hand. My kennel force, some of whom have been in my employ as long as five years, is very efficient and observing; yet there are things the doctor must do daily, in fact several times daily, to see that all is as it should be.

How about that early morning call I got out of bed and rushed down here to meet? The husband "has to be at work by seven," and it is now eight; and still he hasn't arrived. Oh, well, that's part of the life in a small animal hospital, so we just forget it and proceed to the regular routine—checking the records of the hospitalized patients and observing the notations of the kennelman as to defecation, temperatures, coughs, nasal and eye discharges, and the like; making out the work chart for the kennel force to follow in clipping, bathing and dipping; and writing up the feed chart for all patients.

In the course of these routine duties, interrupted by telephone calls and by new patients, time slips swiftly along, and the postman arrives with the morning mail. This is an important occasion. We open each envelope hoping—and after we have read the contents, are still hoping—that the next delivery will bring some of the long-wished-for checks so far past due.

Oh, yes, that early morning call. It is now 10 a.m., and the patient hasn't yet arrived. Well, I guess that dog is dead; or maybe they stopped at another hospital. So we continue further with the daily routine of dressing wounds, treating hospitalized animals, and taking care of the incoming cases, all the while listening to fond owners' accounts of the many cute tricks of each and every patient.

On one trip to the waiting room my attention is attracted to a little wirehaired terrier sitting on the lap of its owner. Its head is dropped and held slightly to one side. There is just a little something about this particular pose which gives me a definite feeling that I know the existing condition and makes me anxious to get to the case. At last, the client and her little dog are brought into the consultation room. The patient's right eye looks as if it would burst from the socket. The pupil is turned to the outer canthus, the membrana nictitans is highly congested and protruding, all the exposed surfaces are very dry, dust covers the cornea, and the dog is unable to close the lid. By this time, I have about made my diagnosis, but not wishing to be too hasty, I question the owner further and make a detailed examination—the best of diagnosticians can sometimes be wrong.

Approaching the patient, I make a quick pass before the eye with my hand to determine whether the sight is impaired. The dog jerks his head away and cries out in pain. This immediately attracts the owner's attention, and she asks excitedly, "What

happened?" Previously, she has been much more interested in the furnishings of the hospital than in what I am doing, but now she feels that I have been unduly rough with a sick dog and is all set to tell me her thoughts about one so unkind. After repeated assurances that I have no intention of hurting any of my patients, I am finally able to obtain the history of the case. She relates, "He was eating his dinner last evening, when suddenly he let out a cry and refused to finish it. I thought maybe he hurt his mouth on a bone, though I did not give him any bones in his feed."

My next step is to try to open the mouth. (In these cases it is usually impossible to open it very wide, if at all.) Palpation over the suborbital region produces severe pain and elicits more sympathy from the owner.

I am now ready to give my diagnosis as a deep abscess in the region of the coronoid process of the mandible. (Frequently as much as two tablespoonfuls of pus can be drained from one of these abscesses on a 15-pound dog. The location of the abscess causes the severe pain produced on opening the mouth, as the coronoid process is forced to move over and through the highly congested area.) I advise the owner of the necessary treatment, and she readily consents after learning that relief can be obtained only by the establishment of drainage.

After anesthetizing the patient, I follow my usual procedure in such an operation. A gag is placed in the mouth and it is opened as wide as possible. Placing the patient on its back, I insert the point of an abscess knife just back of and interior to the last dorsal molar, forcing the blade down and back into the orbital cavity toward the suborbital fat area. If the opening is not made too near the median line, but just interior to the back of the last molar, there will be no bony structure to cut. After inserting the knife an inch or more, I withdraw it. If pus does not follow the knife out, I know I have failed to hit the abscess, and reinsert the knife with the cutting edge toward the larynx, forcing the handle forward as in cutting ligaments or muscles with a nicking knife through a nick in the skin. Completing this operation, I pass a probe into the opening and force it through to the skin over the orbital fat, connecting it with a cut from the top of the head in order to

H. W. Young is a leading small animal practitioner. His hospital, modern and fully equipped, is a model of what such a facility should be. Doctor Young served as president of the Practitioners' Association during the first two years of its organization

establish drainage from the skin through to the mouth. If this opening is made from within the mouth and the knife point is slanted outward, there is no danger of encountering large vessels or nerves. If the point is slanted inward, the optic nerve may be injured.

After drainage has been established, I fill the cavity with an antiseptic ointment, letting the healing tissues force it out. Quite frequently recovery is rapid and one filling is all that is necessary. In other cases, one may have to reopen the cavity several times to obtain the desired result.

Treating this case and explaining conditions to the owner has consumed most of the morning, and the postman has been here again. At the first opportunity I inspect the mail, still hoping. No, no checks; but a postcard to bring a smile and make one feel that life is worthwhile after all. "Dear Mr. Dr. Young, I recon you know who I am, I am the man what had his beetle hound in there the other day what was sick. He is doing fine doctor and I give the pills as you said two and the dog got alright and stopped his coff. I tell everybody what a good doctor you are."

Back to routine again. It is time for lunch —particularly welcome after missing breakfast. The afternoon is spent with more of

the general run of cases and an increasing desire to squeeze in a nap. But as I close my eyes for a surreptitious forty winks, the telephone rings and I am up again with the optimistic thought, "Well, tonight I will make up on that lost sleep."

The afternoon and early evening slip by and as eight o'clock approaches I prepare to go home for a little relaxation. Wait, here comes a man carrying a sick dog. With him are his wife and little girl, the latter crying. The wife explains that she is the one who made that early morning call. Before her husband got off to work, the dog had stopped vomiting and they thought he was going to be all right. They were going out for the day and left him in the basement, thinking he would be himself again by the time of their return, but instead of being better he was much worse. He had vomited all over the basement. They were afraid he was going to die, so rushed him to the hospital. "He isn't serious, is he, Doctor?"

Looking the dog over, I find the tongue and gums ulcerated, skin doughy and dry, pulse almost imperceptible, and temperature 97°F., and give them a very unfavorable prognosis. The man says, "I sure don't want to lose that dog. He has been the constant companion of my little girl for the past six years, and I would pay most any price to save him." The little girl looks up and wails, "Daddy, I told you last week that Vitamin D [some name for a sick dog!] was sick, but you wouldn't listen to me."

After several hours of constant working with the dog, he breathes his last.

And now, I look at the clock to learn it is 10 p.m. Just as I am thinking my day is drawing to a close and I can go home for that much needed rest, the telephone rings and an obstetrical case is on the way to the hospital. We sit, we wait, we wish; and finally the job is completed. We have ushered into this old world a nice litter of nine little puppies.

Again, what time may it be? Three-thirty in the morning—and I still have that sleep to make up, and tomorrow an early morning appointment and an evening committee meeting that will probably last till midnight.

So goes a day in a small animal practice.

The Uses of Calcium Gluconate

A few days ago I was treating a cow for milk fever and she was responding rapidly to the treatment when the owner said, "Doc, are you veterinarians just smarter than M.D.'s, or are cows easier to treat than people?" Of course, I answered with becoming modesty; but little incidents like this make me appreciate calcium gluconate solution. I use it for so many ailments that I am thinking seriously of getting some harmless dyes and coloring it red, green, and yellow, so that my clients won't think I use the same medicine for everything.

For milk fever, I have used all three methods of administration — intravenous, subcutaneous, and half-and-half. I find that if given intravenously the response is more immediate, but it is eliminated more quickly and there is more likely to be a relapse. Giving it all subcutaneously, relapses seldom occur, and the only objection to this method is that it looks so simple the owner is encouraged to try it himself next time. I generally compromise and give it half subcutaneously and half intravenously, thus combining the good features of the two methods.

Of course, I also use other measures in milk fever cases. I have found that a subcutaneous injection of one-half grain of atropine sulphate 15 or 30 minutes after the calcium gluconate gives good results. It helps to raise the blood pressure and the temperature, and also slows down the excretion of the calcium, which is all to the good. I leave two one-half grain atropine sulphate tablets to be dissolved and placed on the tongue every six hours. Then I instruct the owner not to milk the cow or permit the calf to suckle for 24 hours after treatment, and to refrain from stripping the udder for two or three days, ending up with a few well-chosen words on the desirability of a balanced ration.

With this procedure, I have very few relapses in true milk fever—that is, in cases which show the typical subnormal temperature of 92° to 100° F. When the temperature is normal or over, there is generally a streptococcus infection of the uterus or

udder or perhaps of both, and the results of treatment are nothing to write home about. In such cases I have learned from sad experience that it is best to gently prepare the owner to expect the worst, thus at least salvaging my reputation if it is impossible to save the cow.

I also used calcium gluconate as an adjunct to the treatment of acetonemia, prussic acid poisoning, azoturia, heat exhaustion or sunstroke, eclampsia in bitches, sows, ewes, and mares; posterior paralysis, mold poisoning, and metallic poisoning. In debilitating diseases of all kinds, the addition of calcium gluconate to the routine treatment often gives the animal a "lift" that sometimes means the difference between life and death.

R. H. SMITH.

Lewisburg, Tenn.

* * * *

Banana Oil in Small Animal Work

Mrs. J. DeLancey Van Quizzle was a large, generously-upholstered woman, whose home, she impressively informed us, was in Scurvy-on-the-Hudson, one of the most exclusive suburbs of New York City.

Last July, while driving through from Sun Valley, Idaho, to the Pacific Coast, her Pekingese, "Ching," contracted a distressing cold which her maid feared might be developing into pneumonia.

Mrs. Van Quizzle was almost worried sick until the hotel proprietor recommended us very highly. He told her we had doctored his Pekingese twice and it was still alive. Therefore, in her hour of trouble she had brought her precious little pet to us.

When we had completed our examination, we told Mrs. Van Quizzle the condition was evidently due to an allergic reaction to our western climate. In passing through our sage brush country, we explained, which is so dry and dusty in summer it takes three rabbits to raise one young one, "Ching's" nasal membranes had become gravely irritated. It was a rare condition, we added, and only found in dogs of the most royal lineage.

Mrs. Van Quizzle beamed.

We asked the maid about "Ching's" regular diet, and she produced some very expensive canned dog food, which the manufacturer modestly admitted was the best on the market. Inquiring if any raw meat was ever given, Mrs. Van Quizzle shook her head in horror.

About this time "Ching" sneezed and coughed again in a hollow tone that sounded like a wild goose dying with the asthma in a blizzard. We said it was difficult to suggest a cure, but we did happen to have a few very rare tablets which we kept on hand for just such emergencies.

These tablets, we added, were soluble only in raw meat, and one should be given once daily embedded in a small chunk of beef tenderloin. It should be administered exactly at noon, as eleven o'clock might be a little too early and one o'clock too late for the best results.

Mrs. Van Quizzle nodded her head approvingly and reached for her well-filled handbag, and a middle-aged five dollar bill found a temporary new home. Her maid carefully filed away the lactate tablets, and they both returned to the hotel much relieved.

As they were on their way to the coast, which is about 350 miles from here, we figured the ocean breezes would soon stop the flea-hound's wheezes, and, sure enough, our surmise was correct. From Vancouver, British Columbia, we received a letter from Mrs. Van Quizzle requesting us to send her a few more of those wonderful tablets. She explained that while "Ching" had completely recovered, she wanted to keep a few for any future emergency.

We sent her two dozen, and suggested that when she returned home she might be able to secure them from some high-class small animal specialist who also understood the nature and ailments of the Peke.

We hope Grandma Nature will not feel too unkindly towards us for mixing her stuff with small doses of banana oil. Sometimes the judicious use of this lowly ingredient is the only way to make such clients swallow an unpalatable dose of good advice.

E. T. BAKER.

Moscow, Idaho.

Comparison of the Egg Production and Rate of Gain of Birds Negative and Positive to the Pullorum Test*

By LYLE G. NICHOLSON and ERNEST C. McCULLOCH
Pullman, Washington

POULTRYMEN often are confused when their best appearing and heaviest birds give positive reactions to the agglutination test for pullorum disease, while birds in apparently poor condition are negative. The following data, although based upon a small number of birds, are paralleled by our field observations and may be of value in showing the advisability of eliminating pullorum disease reactors from laying flocks.

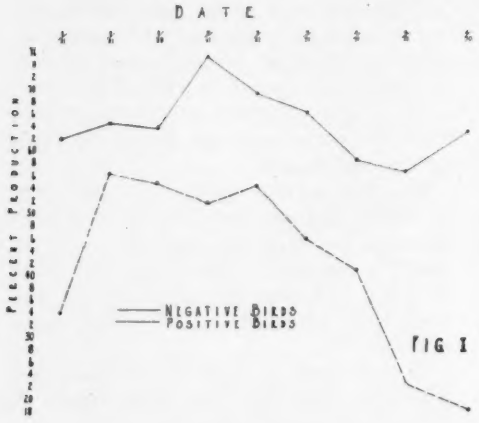


FIG I

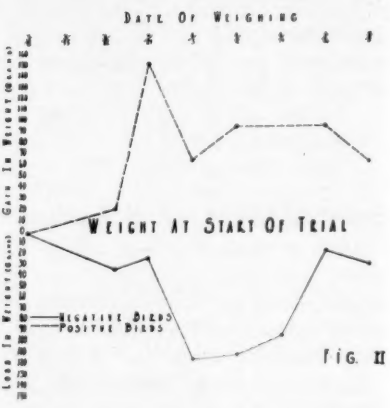


FIG. II

Six adult nonreactors were selected at random from a farm flock. Six reactors in a dilution of 1:100 to the whole blood serum plate and tube agglutination tests were likewise selected at random from the same flock. These birds were placed in individual metal cages and received the same care.

Daily records of individual egg production were made for three months and the averages for ten-day periods are shown in Fig. I. The production of the reactor birds was from 8.4% to 44.7% lower than that of the negative birds. This confirms the work of Kernkamp,[1] who found the production of reactors to be 8.7% less than that of controls.

The birds were weighed weekly and the average gain or loss over the mean group weight at the start of the trial is shown in Fig. II. During the trial the reactor birds weighed from 60 to 180gm more than the negative birds. At the end of the trial the reactors had gained an average of about 60gm, whereas during the same period the negative birds had lost an average of about 30gm.

Probably because of their lower egg production, the reactors gained weight during the period of observation and apparently were in better condition than were the controls. During their period of heavy production, the negative birds lost both weight and condition.

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* Published as scientific paper No. 493, College of Agriculture and Agricultural Experiment Station, State College of Washington.

[1] Kernkamp, H. C. H., 1932. The hatchability of eggs and the livability of chicks of pullorum-infected and non-infected hens. *J.A.V.M.A.* 33, pp. 229-235.

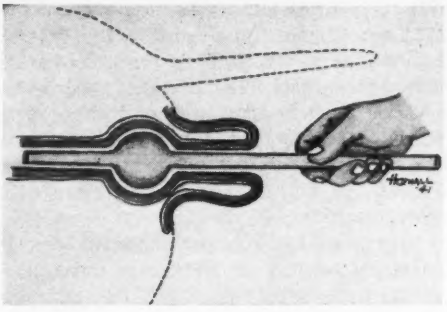
A Convenient Instrument to Facilitate Amputation in Cases of Rectal Prolapse

In performing the surgical procedures indicated in cases of rectal procidentia, the writer has frequently desired some simple piece of apparatus which would support the prolapsed structures and facilitate manipulation without obstructing the field of operation as do fingers or forceps. The instrument described here is an object which was pressed into service in a moment of experimental exigency because it happened to lie within his range of vision while he was confronted with the task of surgical repair of a prolapsed rectum. It did the job so neatly that it has been the instrument of choice in subsequent cases and has earned a niche on the instrument cabinet shelves.

The object in question was nothing more than a glass pipette with ball reservoir—a piece of equipment commonly found in the chemical laboratory. In its new role it still remains a pipette by nature and description, and if it is to be permanently titled an instrument for prolapse surgery, certain departures from the original mold would be desirable. However, even in its present form it introduces a gratifying element of convenience and ease into the operation.

Modus Operandi.—The small tapered end of the pipette is quite easily inserted into the lumen of the protrusion and forced upward until it arrives at the desired position (see illustration). This can be done without the damage to inflamed parts which occurs too frequently when certain metal contrivances are employed for the purpose. It remains fixed in this position for the duration of the operative period, since the pressure of the canal directly around the bulb convexity of the pipette creates a sufficient retention purchase. It can be manipulated by an assistant holding the long stem or graduated end, or by the operator himself, in order to bring the structures into such angles and positions as may be required at various stages of the operation.

Instead of the orthodox ligature, I tack two or three interrupted sutures, uniformly spaced, around the circumference surface before severing the prolapsed portion, for the purpose of temporarily maintaining the parts in place for the permanent sutures. These temporary sutures are removed after the serous-serous and mucous-mucous margins have been united.



Diagrammatic representation of the instrument *in situ*. The bulb of the pipette is sufficiently large that the pressure of the canal around it holds it firmly in place, yet not too large to slip in smoothly and easily. The end protrudes far enough to facilitate manipulation of the instrument

In applying the temporary sutures prior to amputation, the needle can be run through the structures until the point contacts the glass surface of the pipette, then curved back to complete the switch. The glass thus serves as a sort of thimble and prevents the needle from entering other structures.

Similarly, in excising the prolapsed portion of the rectum, the glass offers a base to cut against, so that the knife may be wielded boldly, delivering a clean, uniform cut, without hazard to adjacent tissues.

W. T. HUFNALL

Houston, Tex.

Sulfanilamide for Eczema

Dr. F. W. Gehrman reports success in treating moist eczema in dogs with topical applications of sulfanilamide powder. He clips around the affected area, washes it with soap and water, followed by alcohol, and applies the sulfanilamide powder by means of a shaker top can. The animal should be prevented from licking the wound, in order to avoid its ingesting toxic amounts of the drug.

Thiamin (Vitamin B_1) Deficiency in Mink

By F. S. SWALE, Grafton, Wisconsin

A WISCONSIN mink rancher brought the carcasses of nine mink to the Fromm Laboratories July 15, 1941, for autopsy. He stated that these mink had died during the past 24 hours and that ten more were sick, showing loss of appetite, partial paralysis of the hind legs, staggering gait and weakness. It was the first serious loss on his ranch, which included 700 animals.

Questioned as to the diet, he stated that it consisted of 25% ground horse meat, 25% rabbit from cold storage, 25% fish and 25% commercial mink meal. Three days preceding the loss he had substituted "fish trimmings" for the Great Lakes whole herring that had been fed previously.

Necropsy revealed some enteritis, friable liver, and slight encephalitis. Bladder smears were negative for inclusion bodies of distemper.

Diagnosis.—A tentative diagnosis of vitamin B_1 deficiency—Chastek paralysis[1]—was confirmed by complete laboratory examination, which revealed a marked increase of capillaries and hemorrhage into the central nervous system, renal degeneration, subendocardial hemorrhage, and perivascular infiltration.

Treatment.—Each animal was given 1cc

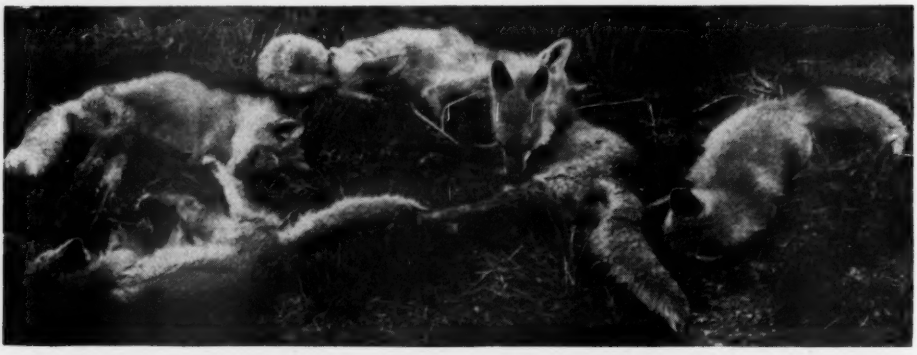
concentrated thiamin (6666 units) subcutaneously. The animals showing symptoms were given the injection intraperitoneally, and the dose was repeated the following day.

All fish was removed from the ration, which was changed to include 80% fresh horse meat, 10% liver, 8% commercial mink cereal and 2% brewers yeast.

Results.—No further cases developed, and six of the nine sick animals recovered. There was a marked improvement in the appetite of all the unaffected animals by the second day after treatment was commenced.

In this case feeding of fish trimmings was the basic fault. It has been recently shown experimentally by Green, Carlson, and Evans that fish trimmings are more effective in producing Chastek paralysis than is whole fish. The treatment was directed toward correcting the diet with food containing vitamin B_1 and giving each animal an immediate supply of thiamin by subcutaneous or intraperitoneal injections. With this treatment the ranch rapidly returned to a healthy condition.

[1] This disease was first recognized and described by Dr. R. G. Green. See VETERINARY MEDICINE, June, 1941, p. 305.



Foxes make equally striking recoveries from Chastek paralysis when thiamin is administered and the diet corrected

Abstracts

Our Present Concepts of Viruses

The discovery that animal diseases, as well as diseases of man and plants, are caused by agents even smaller than the bacteria has induced a multitude of research men to direct their attention to the study of their nature.[1] Their designation as filtrable viruses because of the possibility of passing them through porcelain filters impervious to the passage of other bacteria is now commonly known. More than 30 very destructive diseases of man and approximately 40 diseases of animals are caused by these mystifying viruses. Marked progress has been achieved in qualifying some of the intricacies which heretofore have baffled the scientists.

These achievements were made possible through the development of the ultramicroscope and more recently the electron microscope, which enables us to magnify objects up to 50 thousand times their original size. With the aid of the ultracentrifuge the viruses may be obtained in a more concentrated and clarified form, thus making it possible to determine the molecular size of these bodies. To a great extent, this has also been aided by their filtration through membranes of various porosities.

While the cultivation of viruses on artificial media has not been successful, it has been definitely established that the propagation of viruses is possible in the presence of living cells. Thus, with the aid of tissue cultures and chick embryos, many of the viruses have been propagated. This has resulted in the development of successful vaccines as protective agents against some of the dangerous diseases caused by them. Particular reference is made to yellow fever, equine encephalomyelitis, Rocky Mountain spotted fever, typhus, smallpox, etc.

Scientists are still of varying opinion as to the nature of viruses, whether they should be classed as animate or inanimate bodies. The classical work of Stanley in producing the tobacco mosaic virus in crystalline form is probably the best support of the theory that viruses represent transition between protein molecules and living cells. We are here confronted with the astounding assumption that a simple chemical molecule possesses the capability for self-multiplication, a property which until the present time has been attributed only to living organisms of a complicated structure.

There is also a great deal of evidence to support the contention that viruses of certain diseases may through adaptation become infective for animals which have heretofore shown resistance to them. One cannot eliminate the possibility that many of these viruses were of a common origin, becoming pathogenic to non-susceptible species through adaptation. It will require further painstaking investigation to establish under what conditions such adaptation might be possible. We may hope for more enlightenment on viruses with the aid of the more modern methods of research and through their artificial cultivation in embryos and tissues. The progress made in the past several years is far-reaching, and it is hoped that with our more recent conception of their nature, their mystification will be clarified and the doors opened for a rational control procedure.

[1] Eichhorn, A., 1941. Our present concept of viruses. Presented at the 78th annual meeting of the A. V. M. A., Aug. 11-15, 1941. [Author's abstract.]

The Significance of the "Ceased" Reactor to Bang's Disease

Twenty-one so-called "ceased" reactor cows in two herds (14 in one, six in the other) were allowed to commingle with a total of 54 cows from Bang-negative herds through either one or two gestation periods for each of the normal cows.[2] With the exception of a transitory infection in one quarter of the udder of one of the ceased reactors, *Brucella abortus* was not demonstrated in any of these cows by culture or by guinea pig injection at the time of calving. Moreover, none of the 54 normal cows showed evidence of having been infected by any of the ceased reactors, as evidenced by the lack of agglutinins in their sera for *Br. abortus*, except one individual whose serum

[2] Beach, B. A., M. R. Irwin, and L. C. Ferguson, 1940. The significance of the "ceased" reactor to Bang's disease. *Jnl. Agr. Res.* 61, pp. 75-80.

showed a low titer (1:100) for the organism. This one reactor was in the same herd as the cow showing the transitory infection cited. The writers were unable to demonstrate the organism in this cow either at the time of calving or after slaughter.

The results of these experiments indicate that it is relatively safe to allow ceased reactors to Bang's disease to mingle with non-infected stock. It cannot definitely be said that a ceased reactor cannot be a carrier of *Br. abortus*, but on the basis of these experiments, it can be stated that the probability is undoubtedly small.

Listerellosis in Sheep

A large flock of sheep in southern Illinois suffered an outbreak of listerellosis during the winter of 1938-39. The disease recurred during the winter of 1940-41, while the animals were confined in the same feedlots and sheds where the disease had been observed two years previously.[4]

Symptoms included lassitude, a tendency to circle, paralysis, and death. Anorexia was not a constant initial symptom; however, refusal to come to the feed tank was helpful in detecting early cases, along with a tendency to walk sideways. Circling was not always observed, although all affected animals showed a tendency to hold their heads to one side in the terminal stages of the disease. Frequently affected animals were unable to rise, but continued to move their legs in a running motion. Distinct conjunctivitis was seldom observed. The course of the disease varied from one to four days.

Subcutaneous inoculation with 2 to 10cc of a formolized culture of Listerella apparently failed to reduce the mortality materially. Larger doses of such a culture may be worthy of further trial.

The results of treatment with sulfanilamide in doses of from 60 to 180gr twice daily were inconclusive, but further trial of this drug in the heavier dosage seems warranted.

The disease subsided after the flock was placed on pasture in April.

[4] Henderson, J. A., 1941. An outbreak of listeriosis in sheep. *No. Am. Vet.* 22:9, pp. 545-546.

Book Review

What Are the Vitamins? *By Walter H. Eddy*, Ph.D., Director, Good Housekeeping Bureau, Professor of Physiological Chemistry, Teachers College, Columbia University. Cloth bound; 247 pages, 6 illustrations. Reinhold Publishing Corporation, New York City, 1941. $2.50.

This is a condensation of significant facts about the known vitamins. The vitamins are listed and their general functions are discussed in the two introductory chapters. Chapters Three to Thirteen discuss each vitamin individually, with respect to function, deficiency symptoms, and human requirements. Two appendices give the chemical structure of the vitamins (where this has been determined) and tables of the vitamin values of human foods.

The book is well-compiled and suitable for those who wish to read an up-to-date resumé of the role of the vitamins in human nutrition. There is little or no mention of their application to animal nutrition, aside from reports of work done on experimental animals, in which the emphasis is placed on the human application.

You may obtain any book reviewed in this department by remitting the published price to the Book Department of VETERINARY MEDICINE, 7632 S. Crandon Ave., Chicago, Ill.

Picture Chart of all Dogs (fifth edition) presents a sketch of each of the 108 breeds recognized by the American Kennel Club, divided into the six show groups—sporting, hound, working, nonsporting, terrier, and toy.

World Dog Map (second edition) comprises similar sketches of the 166 pure breeds throughout the world, each identified with the country of its origin.

Both charts are printed in two colors on heavy offset paper, 17 x 22½ inches, and are suitable for framing for the wall of an office, waiting room, library, etc. They may be obtained at $1.00 each or three for $2.00 from Judy Publishing Company, 3323 Michigan Blvd., Chicago.